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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 628815

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	R.H. Rieck, TWRS FBI, H6-11, 376-5034	[] Yes [X] No	09/27/96
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
	Systems Engineering	N/A	ES9
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[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? [X] Yes [] No

This is a complete revision of the TWRS Mission Analysis Report.

Per telecon w/R.H. Rieck, 10/2, revision 1 will be released without the concurrence of J.E. Kinzer, DOE-RL. J. Kirkbride / Sta. 37

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

The review and changes to the Mission Analysis Report were made at the direction of the Department of Energy Richland

15. Distribution (include name, MSIN, and no. of copies)

See Attached List

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ENGINEERING CHANGE NOTICE

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16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
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[ ] Yes	Additional	[ ] $	Additional	[ ] $	Improvement	[ ]
[X] No	Savings	[ ] $	Savings	[ ] $	Delay	[ ]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[ ]	Seismic/Stress Analysis	[ ]	Tank Calibration Manual	[ ]
Functional Design Criteria	[ ]	Stress/Design Report	[ ]	Health Physics Procedure	[ ]
Operating Specification	[ ]	Interface Control Drawing	[ ]	Spares Multiple Unit Listing	[ ]
Criticality Specification	[ ]	Calibration Procedure	[ ]	Test Procedures/Specification	[ ]
Conceptual Design Report	[ ]	Installation Procedure	[ ]	Component Index	[ ]
Equipment Spec.	[ ]	Maintenance Procedure	[ ]	ASME Coded Item	[ ]
Const. Spec.	[ ]	Engineering Procedure	[ ]	Human Factor Consideration	[ ]
Procurement Spec.	[ ]	Operating Instruction	[ ]	Computer Software	[ ]
Vendor Information	[ ]	Operating Procedure	[ ]	Electric Circuit Schedule	[ ]
OM Manual	[ ]	Operational Safety Requirement	[ ]	ICRS Procedure	[ ]
FSAR/SAR	[ ]	IEFD Drawing	[ ]	Process Control Manual/Plan	[ ]
Safety Equipment List	[ ]	Cell Arrangement Drawing	[ ]	Process Flow Chart	[ ]
Radiation Work Permit	[ ]	Essential Material Specification	[ ]	Purchase Requisition	[ ]
Environmental Impact Statement	[ ]	Fac. Proc. Samp. Schedule	[ ]	Tickler File	[ ]
Environmental Report	[ ]	Inspection Plan	[ ]	WHC-SD-WM-FRD-020	[X]
Environmental Permit	[ ]	Inventory Adjustment Request	[ ]		[ ]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

21. Approvals

	Signature	Date		Signature	Date
Design Authority	W C Miller	9/30/96	Design Agent		
Cog. Eng. R.H. Rieck	R H Rieck	09-30-96	PE		
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Environ. J.I. Gould	J I Gould for	9-30-96	Environ.		
Other			Other		
			DEPARTMENT OF ENERGY		
			Signature or a Control Number that tracks the Approval Signature		
			J.E. Kinzer		
			ADDITIONAL		

Tank Waste Remediation System (TWRS) Mission Analysis

R.H. Rieck
Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 628815 UC: 2000
Org Code: 74F30 Charge Code: D1M88
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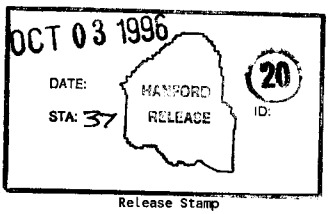
Key Words: Mission Analysis, TWRS, Baseline, Systems Engineering

Abstract: The Tank Waste Remediation System Mission Analysis provides program level requirements and identifies system boundaries and interfaces. Measures of success appropriate to program level accomplishments are also identified.



Release Approval Date

Release Stamp

Approved for Public Release

RECORD OF REVISION

(1) Document Number: WHC-SD-WM-MAR-008

(2) Title: Tank Waste Remediation System Mission Analysis

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
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TANK WASTE REMEDIATION SYSTEM
MISSION ANALYSIS

Approved by:

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U.S. Department of Energy, Richland Operations Office
Date

EXECUTIVE SUMMARY

WHAT IS THE PROBLEM THE TANK WASTE REMEDIATION SYSTEM IS SOLVING?

Indefinite storage of the radioactive, hazardous, and mixed wastes in underground storage tanks as well as cesium and strontium capsules at the Hanford Site pose unacceptable risks to the public, workers, and the environment. Several of the storage tanks have already leaked waste to the environment.

WHAT IS WITHIN THE TANK WASTE REMEDIATION SYSTEM BOUNDARY AND ENVIRONMENT?

The Tank Waste Remediation System (TWRS) scope includes existing and future tank waste, facilities (active and inactive), and future closed immobilized low-level waste (LLW) sites and closed underground storage tanks (double-shell tanks [DSTs], single-shell tanks [SSTs], and miscellaneous underground storage tanks [MUSTs]), as well as disposition of encapsulated cesium and strontium.

WHAT ARE THE TWRS INTERFACES?

Major TWRS physical interfaces include receipt of additional waste and materials from both onsite and offsite, discharge of liquids, solids, and gases, and ultimate shipment of vitrified high-level waste (HLW) to the HLW repository. Major programmatic interfaces include transmittal and receipt of cost, schedule, and status information, as well as receipt of regulations, guidance, and authorizations from both internal and external sources.

WHY WAS THE TWRS PROGRAM ESTABLISHED?

The TWRS Program was established by the U.S. Department of Energy (DOE) to: 1) manage and dispose of waste contained in underground storage tanks at the Hanford Site, 2) dispose of the encapsulated cesium and strontium, 3) close assigned operable units, and 4) decontamination and decommissioning of TWRS facilities.

WHAT ARE THE TWRS MISSION GOALS?

The primary goal of the TWRS Program is to minimize the environmental, safety, and health risks associated with existing waste stored in the DSTs, SSTs, MUSTs, and the encapsulated cesium and strontium.

WHAT IS THE TWRS PROGRAM STRATEGY?

TWRS will retrieve approximately 99% of the SST and DST waste. This waste will be separated into LLW and HLW fractions. The resulting HLW volume will be reduced through chemical treatment. The non-radioactive fraction separated from the HLW will be combined with the LLW. The LLW radioactivity will be reduced using chemical separations techniques. The radionuclides separated from the LLW will be combined with the HLW. The treated wastes will then be immobilized for storage followed by disposal. The remaining structures associated with SSTs and DSTs will be isolated from the environment in accordance with an approved closure plan. Closure of MUSTs supporting SST or DST operations will be performed in accordance with the respective SST or DST closure plan. Cesium and strontium capsules will be decontaminated, dispositioned, and stored until shipped to a federal repository.

The physical systems required to perform the TWRS mission will be acquired through a combination of privately-owned and government-owned/contractor-operated resources.

INITIAL STATE

TWRS initial conditions are as follows:

- Existing tanks and tank waste - There are 149 SSTs, 28 DSTs, and 63 MUSTs. Some of these tanks have leaked. The waste within these tanks has not been fully characterized.
- New tank waste - New waste continues to be received in the DSTs from other Site programs and tank farm operations. No new waste is being added to the SSTs or MUSTs.
- Cesium and Strontium - Encapsulated cesium and strontium is stored onsite primarily at the Waste Encapsulation and Storage Facility and offsite at various locations.
- Facilities - There are several facilities within the TWRS scope. The capabilities of these facilities vary from fully operational at various levels of efficiency to fully inoperable.

ACCEPTABLE END STATE

At the completion of the TWRS mission, the final conditions are expected to be:

- Tank Waste - LLW and HLW will be immobilized and safely stored.
- Storage Tanks - SSTs, DSTs, and MUSTs will be closed in accordance with an approved closure plan.
- Cesium and Strontium - Cesium and strontium capsules will be moved to a federal repository.
- Facilities - Facilities will be decontaminated and decommissioned and closed by TWRS or turned over to the environmental remediation mission area.

PROGRAM ASSUMPTIONS

In performing the TWRS mission analysis, certain assumptions were made. An effort must be made to eliminate these assumptions, and appropriate changes made to the approach in meeting the TWRS mission requirements.

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LIST OF FIGURES

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LIST OF TERMS

AEA	*Atomic Energy Act of 1954*
CFR	Code of Federal Regulations
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOH	U.S. Department of Health and Human Services
DST	double-shell tanks
DWPF	Defense Waste Processing Facility
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ES&H	Environmental, Safety and Health
ETF	Effluent Treatment Facility
GOCO	Government-Owned/Contractor-Operated
HLW	high-level waste
JMN	Justification for Mission Need
LLW	low-level waste
MOA	Memorandum of Agreement
MUST	Miscellaneous Underground Storage Tanks
NRC	Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
OSHA	Occupational Safety and Health Administration
PRIMS	Programmatic Risk Information Management System
PUREX	Plutonium Uranium Extraction
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	DOE, Richland Operations Office
Sr	Strontium
SST	single-shell tanks
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TWRS	Tank Waste Remediation System
WAC	Washington Administrative Codes
WESF	Waste Encapsulation and Storage Facility
WIPP	Waste Isolation Pilot Plant
WVDP	West Valley Demonstration Project

INTRODUCTION

Why was the Tank Waste Remediation System Established?

The U.S. Department of Energy (DOE) established the Tank Waste Remediation System (TWRS) Program to manage and dispose of the waste contained in underground storage tanks at the Hanford site. The TWRS Justification for Mission Need (JMN) (DOE 1993) states that the purpose of the TWRS Program is to:

- Resolve the waste tank safety issues;
- Integrate the waste disposal mission with the ongoing waste management mission;
- Assess the technical bases for tank waste management and disposal;
- Determine the technology available and develop any needed technologies;
- Establish a dedicated organization and provide the resources to meet the technical challenge.

PROBLEM DEFINITION

What is the Problem TWRS is Solving?

Indefinite storage of radioactive, hazardous, and mixed wastes in underground storage tanks and the cesium and strontium capsules at the Hanford Site pose unacceptable risks to the public, workers, and the environment. The tank contents are not fully characterized and several of the tanks have leaked waste to the environment.

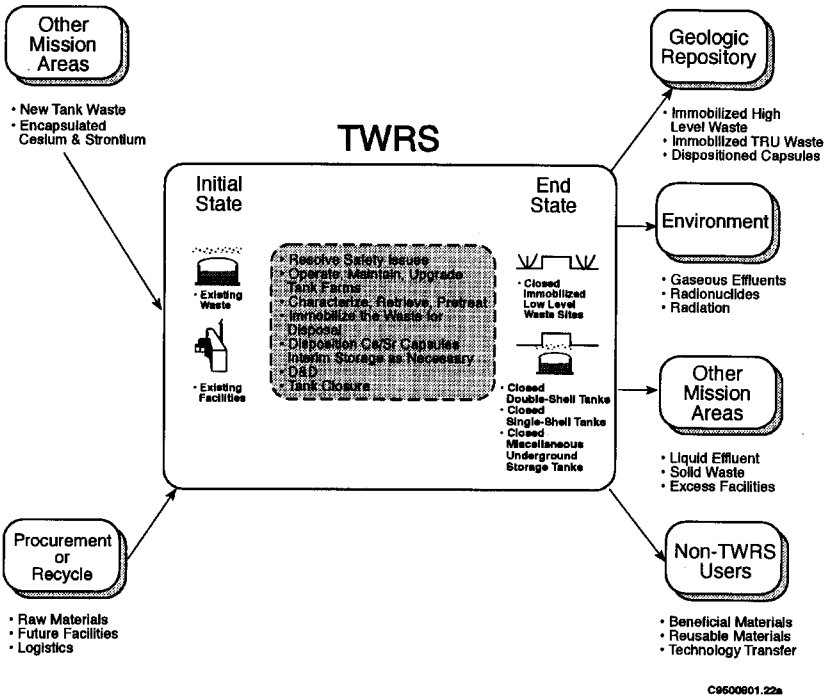
SYSTEM BOUNDARY AND EXTERNAL INTERFACES

What is Within the TWRS Boundary and Environment?

The TWRS scope (as defined in the JMN and Site Technical Baseline) includes existing and future tank waste, TWRS facilities (active and inactive), and future closed immobilized low-level waste (LLW) sites and closed underground storage tanks (double-shell tanks [DSTs], single-shell tanks [SSTs], and miscellaneous underground storage tanks [MUSTs]), as well as disposition of cesium and strontium capsules (see Figure 1).

The system to remediate the tank waste (TWRS) is a subsystem of the larger Hanford cleanup system. TWRS must be fully integrated with the other subsystems of the Hanford cleanup system to successfully meet the mission goals and objectives of the site cleanup. Figure 1 describes the actual TWRS boundaries with their associated inputs and outputs. It is important to understand that the TWRS boundary encompasses only existing waste and facilities.

Figure 1. TWRS Boundary Diagram.



What are the TWRS Interfaces?

The TWRS physical and programmatic interfaces are defined below.

TWRS Physical Interfaces

The onsite interfaces include receipt of new tank waste and encapsulated cesium and strontium from other cleanup mission areas, receipt of raw materials, waste products to and from existing and future facilities, and those necessary to handle and transport waste and materials. TWRS interfaces with the environment by discharging gaseous effluents in accordance with Federal, state, and local laws. As TWRS supports other Hanford mission areas, other mission areas support TWRS by accepting liquid effluents, solid waste, and excess facilities. Other potential interfaces include the use of beneficial materials, reusable materials, and transferring of technology.

The primary offsite interface for TWRS is the high-level waste (HLW) repository and the Waste Isolation Pilot Plant (WIPP). TWRS depends on the HLW repository to accept immobilized HLW, or dispositioned cesium and strontium capsules. Acceptance criteria for a single "standard" waste form and canister have been established. Acceptance criteria for other potential waste forms from TWRS are under development (Issue #7).

The actual physical systems (old or new) that will make up this TWRS system along with the skilled people and technologies required to accomplish the mission will be provided. Performance and design requirements will be embodied in the essential capabilities supplied.

TWRS Programmatic Interfaces

The TWRS program will work with programs in other Hanford mission areas (e.g., Solid Waste Program, Liquid Effluent Program) to transmit data on waste and materials to be transferred, establish schedules, and relay processing status. DOE, Richland Operations Office (RL) will require status, plans, reports, identification of program needs, and will provide control, guidance, and authorization to perform work. External to Hanford, programs and agencies (e.g., Washington State Department of Ecology [Ecology], Nuclear Regulatory Commission [NRC], U.S. Environmental Protection Agency [EPA], Occupational Safety and Health Administration [OSHA], U.S. Department of Health and Human Services [DOH], repository programs, and Congress) will impact the TWRS via regulations, guidance, acceptance criteria for final state of wastes, and approval of resources. Washington State also impacts the TWRS as a stakeholder.

MISSION STATEMENT

What is the TWRS Mission?

The TWRS mission is to manage and immobilize for disposal the Hanford radioactive waste in a safe, environmentally sound, and cost-effective manner. The scope of TWRS includes all activities and projects needed to: 1) resolve safety issues, 2) operate, maintain, and upgrade the tank farms and supporting infrastructure, 3) characterize, retrieve, pretreat, and immobilize the waste for disposal (with HLW interim storage as necessary), and tank closure (DOE 1993). TWRS is also responsible for closure of assigned operable units, as well as decontamination and decommissioning (D&D) of TWRS facilities.

What are the TWRS Mission Goals, Objectives, and Measures of Success?

The primary goals and objectives of the TWRS Program are identified in Table 1.

Table 1. TWRS Mission Goals and Objectives.

GOAL	OBJECTIVES
Operate and maintain facilities to provide continued safe and environmentally sound storage (JMN)	Resolve tank system safety issues
	Upgrade facilities as necessary and practical until such time as they can be closed
	Reduce operating cost to minimum levels necessary to safely manage the tank waste
Retrieve the tank waste	Prepare tank for reuse or closure
	Remove 99% of waste from SSTs or to the limit of technology
	Close DSTs and MUSTs
Pretreat the tank waste	Minimize impact on repository and Hanford land use
Immobilize and dispose of any remaining mixed or LLW	Minimize safety and environmental risk
	Minimize volume of LLW
Close the underground storage tanks	Minimize safety and environmental risk
Immobilize HLW and transuranic (TRU) constituents of waste	Minimize safety and environmental risk
	Minimize volume of HLW
	Enable permanent disposal
	Interim storage of HLW
	Disposition of cesium and strontium
D&D and close most TWRS facilities (a limited number of older facilities will be transferred to the Environmental Restoration [ER] mission area)	Minimize the number of active facilities
	Reduce operational liabilities
	Minimize generation of secondary waste and effluent to reduce environmental impact and cost

SYSTEM LIFE-CYCLE

What is the TWRS Life-Cycle?

The TWRS life-cycle can be described in terms of three phases; (1) maintaining existing safe conditions focused on safe storage of tank waste, (2) disposal operations with emphasis on retrieving the waste, treating the waste for disposal and disposing the waste, and (3) post-closure activities, including the long-term monitoring of immobilized LLW and closed underground storage tanks.

The entire system can be in more than one phase at a time. Each phase can be defined to begin with and consist of identifiable activities as discussed below.

(1) Maintaining existing safe conditions is currently underway, and will be complete when there is no more waste to safely store.

(2) The disposal phase begins with the planning of initial retrieval of tank waste for treatment, immobilization, and disposal. This phase will be complete when all waste (including excess facilities, tank waste, waste byproducts, and closed tank sites) has been dispositioned (this includes tank waste, facilities, tank structures, and transfer piping; may include pre-closure monitoring).

(3) Post-closure activities begin when the first immobilized LLW site is closed and ready for monitoring. The end of this phase will be defined by termination of monitoring the closed sites (may include post-closure monitoring of closed waste tank sites).

What is the TWRS Operations and Maintenance Concept?

TWRS operations and maintenance philosophies for existing facilities and for evolving projects will be based on the Life-Cycle Asset Management Good Practice Guide GPG-FM-004 and GPG-FM-031. In addition, TWRS implementation instructions for logistics support planning and analysis and systems and cost effectiveness will be utilized to determine systems operational and maintenance concepts.

For existing TWRS facilities, a graded approach shall be employed for development of an operational concept which meets current TWRS operational requirements. Current operations employ continuous "round-the-clock" schedules for waste management activities. The storage, transfer, and concentrate functions plan activities on either day or "back shifts," while the characterize function only plans "back shift" activities on an as needed basis. The current status of the tank farm maintenance program for existing facilities is documented in the Maintenance Implementation Plan (MIP, WHC-SP-0850). The balance of maintenance activities includes 70% and 30% resource utilization on unplanned and planned maintenance, respectively. The current maintenance philosophy recognizes the deficiencies associated with running equipment to failure and identifies mechanisms to lessen unplanned maintenance activities, subsequently maximizing design life and improving operational efficiency.

The operational concept for future TWRS facilities must sufficiently describe the intended use of the total system in order to develop the proper supporting requirements. Future facilities will be operated on continuous "round-the-clock" schedules for treatment, storage, and disposal activities, and will be operated to achieve a total TWRS systems operational availability of 60%. The maintenance program shall support the operational availability rating. Future TWRS facilities shall derive an operational concept which includes at a minimum:

- Mission definition
- Upper level performance and physical parameters
- Operational life-cycle
- Utilization requirements
- Effectiveness factors
- Operational environment

When the operational requirements are established, the maintenance concept will be developed which provides for optimized maintenance logistics support throughout the operational life-cycle. The maintenance concept reinforces the operational concept by defining the:

- Levels of maintenance support
- General repair policies and/or constraints
- Organizational responsibilities for maintenance
- Major elements of logistics support
- Support effectiveness requirements
- Maintenance environment

When thoroughly implemented, the operational and maintenance concepts will provide the basis for detailed system life-cycle asset management, and facilitate completion of the TWRS mission.

WHO ARE THE STAKEHOLDERS AND WHAT ARE THEIR EXPECTATIONS?

The stakeholder groups include the general public, action groups, such as the Hanford Advisory Board and Native American Indian Tribes; federal bodies, such as the DOE and EPA; state bodies, such as Ecology; and Site contractors. TWRS stakeholder values are listed in Appendix A, Table A-1.

MISSION-LEVEL REQUIREMENTS

What are the Top-Level Mission-Driven Requirements?

Table A-2 in Appendix A present the TWRS top-level mission-driven requirements.

What are the Applicable Requirement Source Documents for Externally Imposed Requirements?

Externally imposed requirements include applicable Federal, state, and local legislation, as well as associated statutes, regulations, codes, and standards.

Appendix B, Table B-1 contains the requirements that have been identified at the mission-level which have quantifiable values. The first column contains the regulation citing, a short description of the regulation follows in the second column, and the third column gives a number or value that is pertinent to the TWRS mission. Also, TWRS requirement source documents are identified in Tables B-2, B-3, B-4, and B-5.

What is the TWRS Program Strategy?

The strategy is described below in two parts, the technical strategy and the program management strategy.

The TWRS Technical Strategy

From the JMN, the TWRS technical strategy is to:

- Mitigate (interim reduction of severity) or resolve (eliminate) safety issues;
- Manage the waste and operate the tank farms in a safe and environmentally-sound manner;
- Restore or upgrade existing facilities and build new facilities to the extent required to support the Hanford cleanup mission;

The September 1994 *Hanford Mission Plan*, (DOE/RL 1993) adds the following to the technical strategy:

- Tank waste from both SSTs and DSTs will be retrieved for immobilization and stable disposal;
- Waste will be separated into HLW and LLW fractions;
- LLW will be immobilized and disposed onsite utilizing performance assessments to establish LLW storage requirements;
- HLW will be immobilized for onsite interim storage and eventual disposal in an offsite geologic repository;
- Residual waste remaining in the tanks after retrieval operations are completed, in-tank equipment, tank structures, and any underlying or adjacent contaminated soils will be disposed in-place after suitable treatment utilizing performance assessments to establish tank closure requirements.
- Cesium and strontium capsules will be dispositioned for disposal in a geologic repository (see Issue 11).

For disposition of transuranic (TRU) tank waste, the technical strategy is:

- TRU tank waste will be blended with HLW and immobilized for disposal in a geologic repository (Taylor 1996).

The TWRS Program Management Strategy

The success of the TWRS program depends on developing and implementing a fully-integrated technical and management strategy. To accomplish this, the TWRS Program will operate under a single major system acquisition (MSA) management approach. This will integrate TWRS operations, technology development, and project activities using a systems engineering approach. Program documentation will be developed to ensure that consistent controls and requirements are established for managing the TWRS program (DOE 1993).

In order to complete the TWRS Mission Analysis, several issues were identified. Assumptions were made which allowed continuation of existing work efforts at some additional risk. The identified issues and enabling assumptions will be tracked and resolved using the TWRS Risk and Decision Management procedures.

From the JMN the program management strategy is to:

- Establish and implement a program management system to achieve sound, timely decision-making and mission execution;
- Create and maintain a program environment that embodies the principles of leadership, empowerment, and quality to promote a bias for action;
- Establish and maintain communication to achieve program credibility and institutional support;
- Transfer technology and communicate lessons-learned to enhance the waste management practices of the government and the competitiveness of U.S. industry;
- Prepare an Environmental Impact Statement (EIS) for TWRS. Prepare project-specific safety and environmental documentation for all proposed actions and projects, as appropriate;
- Provide a retrieval system;
- Provide a waste transfer and feed or lag storage system;
- Provide a pretreatment system;
- Provide a HLW immobilization and interim storage system;
- Provide a LLW immobilization and onsite disposal system;
- Adopt and develop technologies to accomplish the technical strategy;
- Provide a Tank Closure Plan.

Though not mentioned in the JMN, disposition of the cesium and strontium capsules (assuming they are reclassified as waste) is also part of the TWRS Program responsibility (Ecology, et al., 1994).

What is the TWRS Acquisition Strategy?

The physical systems required to perform the TWRS mission will be acquired through a combination of privately owned and government-owned/contractor-operated (GOCO) resources in a two-phased acquisition strategy. During the first phase, private contractors will demonstrate the separation of radionuclides from the waste supernatants and demonstrate the immobilization of HLW and LLW. During the second phase, private contractors will operate the tank farms, retrieve waste, and treat and immobilize waste. Workscope not performed by private contractors will be performed by GOCO resources.

INITIAL STATE

What are the Initial Conditions for the TWRS?

The initial conditions for TWRS wastes and facilities are described below. DOE Order 5820.2A is the primary requirement for HLW and LLW and current noncompliance is a primary reason the TWRS is in an unacceptable state.

Existing Tank Waste

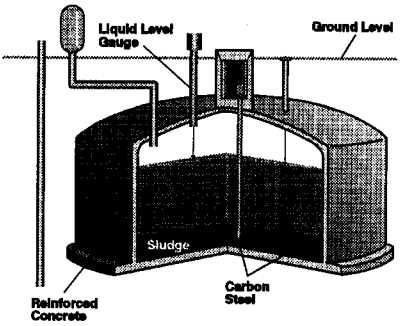
The tank waste includes the current contents of 149 SSTs, 28 DSTs, and 63 MUSTs total (identified as of June 1996), of which 36 belong under TWRS ownership (identified as of October 1995). There is approximately 213,300 m^3 (56 Mgal) of radioactive and hazardous (*Resource Conservation and Recovery Act of 1976* [RCRA]) wastes stored at the Hanford Site in these tanks. Figures 2, 3, and 4 present summary information on the current tank waste conditions (Hanlon 1995, Powers 1995, Rymarz and Speer 1991, and Nielsen 1992).

The wastes are by-products of the chemical processing of irradiated nuclear reactor fuel and consist of liquid, saltcake, and sludge. While overall waste quantity estimates have reasonable technical bases, detailed and complete characterization of the waste is needed for each tank (e.g., determination of physical and chemical properties). Waste characterization is required for regulatory compliance and to fulfill information needs of safety, retrieval, pretreatment, immobilization, and disposal projects.

Sodium salts represent the primary waste constituent and dominate the solids volume of tank waste. The nitrate ion (NO_3^-), primarily as sodium nitrate, comprises the largest volume of hazardous chemicals in the tanks. Nitrates in both the tanks and existing soil and groundwater contamination dominate the non-carcinogenic hazard impact for long-term groundwater risk (Hesser et al. 1995). Uranium is the most prevalent heavy metal and radioactive element but its chemical and radiological toxicities are relatively low. The highly mobile chromium in the waste is a heavy metal of concern in groundwater contamination (Boothe 1995). The inventory of hydroxide ion (OH^-), primarily as sodium hydroxide, is used to control the in-tank chemical conditions. Cesium-137 and strontium-90 (and equilibrium decay daughters) dominate the current total waste activity and are the radioisotopes of concern for external dose in accident analysis and worker exposure in the near-term along with internally deposited plutonium (Boothe 1995).

Figure 2. Single-Shell Tanks.

Single-Shell Tanks



- 149 Tanks Constructed 1943-64
- ~210 m^3 to 3,800 m^3 Capacity (55 kgal to 1 Mgal)
- Bottom of Tanks at Least 50 m (150 Feet) Above Groundwater
- No Waste Added to Tanks Since 1980
- Tanks Currently Contain:

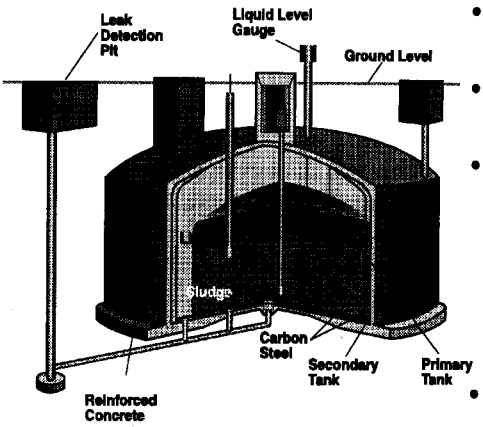
  ~136,800 m^3 (36 Mgal) of Salt Cake, Sludge, and Liquid

  ~460 x 10^{16} Bq (124 MCi) (12/31/93 Basis)
- 67 Have Leaked
  ~ 2,300-3,400 m^3 (600-900 kgal)

C950801.15

Figure 3. Double-Shell Tanks.

Double-Shell Tanks

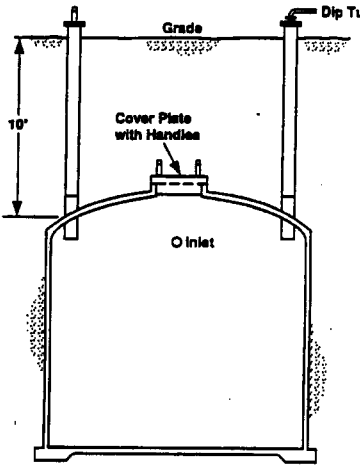


- 28 Tanks Constructed Between 1968-86
- ~3,800 m^3 to 4,300 m^3 (1 to 1.14 Mgal) Capacity
- Tanks Currently Contain
  - ~ 75,800 m^3 (20 Mgal) of Mostly Liquids (Also Sludges and Salts)
  - ~ 300 x 10^{16} Bq (84 MCi) (12/31/93 Basis)
- None Has Leaked

C950801.16

Figure 4. Miscellaneous Underground Storage Tanks.

Miscellaneous Underground Storage Tanks



- 63 Inactive Tanks as of October, 1995 currently contain:
  - ~ 700m³ (0.2 Mgal) of liquids with some sludges
- ~ 4m³ to 190m³ capacity (955 gal to 50 kgal)
- Use Dates: 1946-1985
  - 36 owned by TWRS as of October 1995 ~455m³ (120 kgal)
  - 21 assigned to other Programs
- 18 Active Tanks ~265m³ (70 kgal 6/30/95)

C9500801.21

The plutonium and americium inventory determines whether tanks contain TRU waste above the statutory level of 100 nCi/g requiring geologic disposal. Inhalation dose from americium-241 and plutonium for both workers and the public can be significantly greater than external dose. Shielding studies to date, in support of facility pre-conceptual design, indicate that other radionuclides such as europium-154 are important (Boomer et al. 1994). Technetium-99, Iodine-129, and Neptunium-257 are typical of the highly mobile, long half-life radionuclides and dominate the long-term radiological groundwater contamination risk, while tin-126 is the main long-term external gamma radiation hazard for solid waste retained in the tanks (Boothe 1995). A summary of the selected tank contents is given in Table 2 (Golberg 1995).

Table 2. Selected Tank Contents.

Constituent	SST	DST	Total
Sodium(kg)	5 E+07	1 E+07	6 E+07
Nitrate(kg)	1 E+08	1 E+07	1 E+08
Nitrite (kg)	5 E+06	5 E+06	1 E+07
Hydroxide(kg)	5 E+06	2 E+06	7 E+06
Chromium(kg)	1 E+05	9 E+04	2 E+05
Uranium(kg)	1 E+06	3 E+04	1 E+06
Plutonium(kg)	3 E+02	2 E+02	5 E+02
Number of tanks with TRU content > 100nCi/g	55	7	62
Americium-241 (Bq)	1 E+15	3 E+15	4 E+15
Plutonium-239(Bq)	7 E+14	3 E+14	1 E+15
Strontium-90(Bq)	2 E+18	4 E+17	2 E+18
Cesium-137(Bq)	3 E+17	1 E+18	1 E+18
Technetium-99(Bq)	4 E+14	8 E+14	1 E+15
Iodine-129 (Bq)	6 E+11	--	6 E+11
Neptunium-237 (Bq)	3 E+12	--	3 E+12
Europium-154(Bq)	--	2 E+15	2 E+15
Tin-126(Bq)	2 E+13	--	2 E+13

Decay basis date: 12/31/99

Reference: Golberg, 1995.

New Tank Waste

New waste continues to be received in the DSTs from other Site programs and tank farm operations. These receipts are relatively small in comparison to past activities. The primary sources of new waste entering the TWRS are waste solutions generated from:

- Surveillance and deactivation of canyon facilities and the Plutonium Finishing Plant (500 kgal [Strode 1995]);
- 222-S Analytical Laboratory operation;
- T Plant decontamination facility operation;
- Facility cleanout and experimental activities in the 300 Areas;
- Deactivation activities in the 400 Area;
- Evaporator and tank line flushes;
- Dilution of existing tank waste for retrieval and pretreatment.

New liquid wastes are expected to be generated at a total rate of 75 to 150 m^3 (20 to 40 kgal) dilute per month from facility generation sources such as 300/400 Areas, S Plant, T Plant, B Plant, the Plutonium Uranium Extraction (PUREX) Facility, and from the tank farms themselves. From 1995 to 2015, an accumulation of newly-generated wastes of 19,000 to 38,000 m^3 (5 to 10 Mgal) would be generated (Strode 1995). Additionally, approximately 150,000m^3 (40 Mgal) of liquid waste is expected to be generated from evaporator and tank line flushes, dilution of existing tank waste for retrieval and pretreatment, sludge washing, and other pretreatment activities during that same period (Strode 1995). Over that 20-year period, this added liquid would be offset by volume reductions from TWRS activities (evaporation and disposal).

New waste additions may occur from other future program activities, but the additions are not fully defined at this time. Examples of these potential new additions include:

- Slurries containing sludge from spent fuel storage basin deactivation (preliminary, estimated magnitude of 1,900 m^3 [500kgal]) (Strode 1995);
- Liquid waste generated by future facility D&D activities;
- Liquid wastes generated by future solid waste treatment facilities;
- Liquids from burial trench leachate collection systems;
- Liquids from groundwater treatment activities.

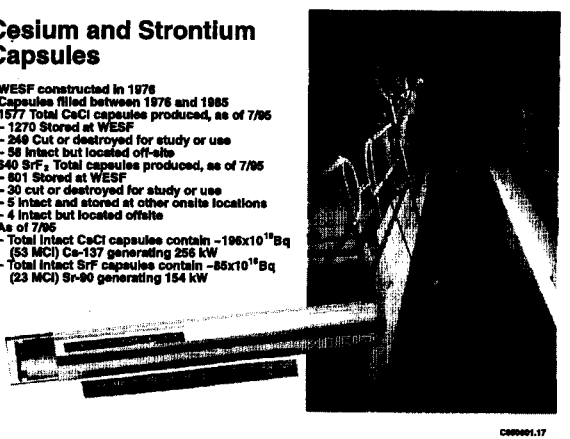
These waste streams are dependent on the final configuration selected for generator systems and results of trade-off studies comparing disposition alternatives. A final decision to include these wastes in the TWRS will be considered on a case-by-case basis in the future.

Dispositioned Cesium and Strontium

Encapsulated cesium and strontium is currently being stored onsite at the Waste Encapsulation and Storage Facility (WESF) and offsite at various locations. These capsules are currently classified as waste by-product material until such time as they are declared to no longer be useful or potentially useful. Tank Farm Transition Projects are the current "owners" of the capsules and retain responsibility for their ongoing safe and environmentally acceptable storage until TWRS has the capability to process the capsules (overpack or vitrify) for offsite geologic disposal. Because the capsules are still classified as waste by-product, they are not subject to regulatory oversight other than as provided by the *Atomic Energy Act of 1954* (AEA) and pertinent DOE orders. A summary of the capsule data is contained in Figure 5.

The lifetime integrity of these capsules is questionable due to a capsule failure after shipment offsite. The capsule failure investigation group noted important differences in operation at the offsite company and WESF (e.g., WESF thermal cycles are more controlled) that tended to reduce the concern for failure of capsules stored at WESF. However, a specific failure mechanism could not be verified (DOE/ORO-914 1990).

Figure 5. Cesium and Strontium Capsules.



Existing Facilities

Tank Equipment and Other Waste Materials

Many SSTs contain equipment and materials in addition to the typical waste sludge, salt cake, and liquids. These materials were discarded prior to November 1980 as part of storage and transfer operations, full-scale experiments, and development activities. Discarded equipment included large installed hardware, such as air lift circulators, thermocouple trees, coils, and sluices. Materials added to some tanks include experimental fuel elements, cobalt slugs, diatomaceous earth, portland cement, and other miscellaneous items such as sample bottles. Some DSTs contain installed equipment, such as air lift circulators and thermocouple trees, to support storage operations. However, material additions to DSTs have been limited to typical waste chemicals.

Tank Structures

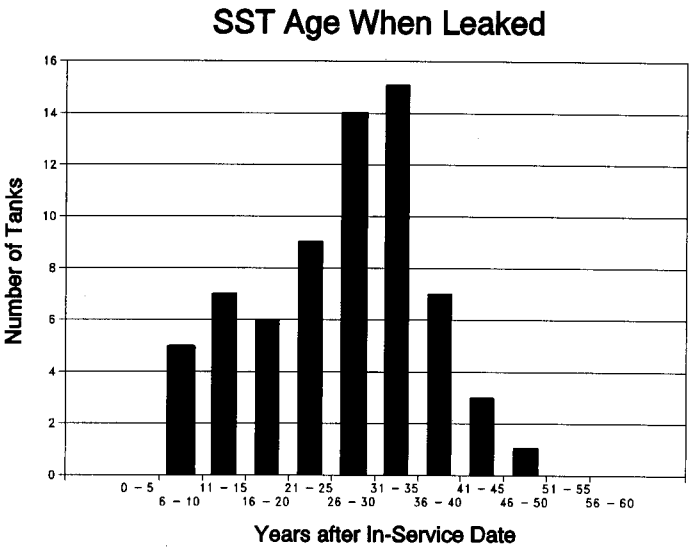
Waste storage capacity is required for current waste inventories and new waste from retrieval, disposal operations, and other Hanford cleanup activities. The integrity of tank structures can impact the schedule for completing the TWRS mission. None of the 28 DSTs have leaked, 82 SSTs continue to be considered sound (although new waste additions are not allowed), and 67 SSTs are assumed to be leakers and may have discharged approximately 2,300 to 3,400 m^3 (600 to 900 Kgal) and 1.1 to 4.1 x 10^{16} Bq (300 to 1,100 kCi) of cesium-137 into the surrounding soil (Hanlon 1995). Most leak volumes are less than 20 m^3 (5,000 gal).

According to the original design criteria, the tank structure design life is generally on the order of 20 to 50 years for DSTs and 20 years for SSTs (Julyk et al. 1995). The sound SSTs have generally reached or exceeded the projected design life. The oldest DSTs will reach their upper end design life in approximately 25 years while the newest DSTs will reach their upper design life in approximately 40 years.

DSTs provide the only active storage capacity for liquid waste and are an integral component of many disposal configurations. Therefore, the predicted onset of leaks in DSTs can become an important factor in scheduling disposal activities. The historical data for tank age when leaks were observed is presented in Figure 6 for SSTs. The mechanisms of tank failure are complex and varied (dependent on waste conditions, cathodic protection, construction techniques, etc.) such that SST failures cannot be directly used to predict DST failures. However, the data does indicate that actual tank service ages could form a distribution around the design life. Applying this concept to DSTs leads to a prediction that some DST failures could be observed prior to reaching the design life and potentially accelerate the need to complete some disposal activities while a full compliment of 28 DSTs are available.

The 200 Areas also contain MUSTs used as catch tanks, as neutralization or settling tanks, for uranium recovery support, for waste handling in the tank farm system, or to support waste handling from a specific facility. Powers (1995) provides a summary list of approximately 63 inactive MUSTs (identified to date) and tentatively assigns programmatic responsibility for approximately 36 tanks to the TWRS. Over the years, these MUSTs have been removed from service, inlet lines have been blanked, and monitoring activities have been terminated. Most of the tanks contain radioactive chemical sludges and a liquid heel. The tank locations are varied; some near processing plants, pipeline diversion boxes, and cribs and reverse wells.

Figure 6. SST Age When Leaked.



An additional 18 MUSTs are listed in Hanlon (1995) that are still in use to support waste transfers and storage within the TWRS. These vessels are primarily double-contained receiver tanks, catch tanks, and diversion boxes.

Other TWRS Facilities

In addition to tank structures, the TWRS currently includes facilities to support storage and transfers of tank waste. These facilities include a concentration facility and ancillary encased transfer lines, vaults, and valve pits. Tank waste concentration is used to efficiently utilize available tank storage space.

The 242-A Evaporator is located in the 200 East Area of the Hanford Site. The 242-A Evaporator was constructed in 1976 to be the primary mechanism for reducing the volume of wastes stored within the Hanford site underground storage tanks.

The 242-A Evaporator was restarted in April 1994 and will continue to be operated as necessary to reduce the volume of wastes requiring storage in the DST system. Recent upgrades to the 242-A Evaporator are projected to extend its service life until 2005. However, current plans require the use of the 242-A Evaporator through 2011.

Encased transfer lines, vaults, and valve pits support the transfer of waste. The current system contains transfer system elements that are both active (in use) and no longer in service due to line failure, pluggage, or intentional capping in support of tank isolation activities. Transfer lines exist among tanks within the 200 East and 200 West Areas. A cross-site transfer system is in place to support tank waste transfers between the 200 Areas. The cross-site transfer system consists of six transfer lines, four of which are either plugged or suspected of having failed. One cross-site transfer line is of uncertain integrity.

ACCEPTABLE END STATE

The Hanford Advisory Board tasked the Hanford Future Site Uses Working Group with the evaluation of potential future uses of the Hanford site. This working group was comprised of Federal, tribal, state, and local governmental entities and representatives of concerned constituencies. Their findings were published in December 1992 in a document, "The Future for Hanford: Uses and Cleanup." Those findings included recommendations for all portions of the Hanford Site, including the 200 Area complexes. Consistent with the published recommendations for the future uses of the Hanford site, the TWRS EIS states; "The 200 Areas and the surrounding Central Plateau have been identified as potential exclusive-use waste management areas to support the Hanford Site's waste management and environmental restoration programs." Issue #13 identifies the uncertainty which exists with respect to the future use of Hanford. The enabling assumption indicates that the findings of the Hanford Future Site Uses Working Group will be used as the guidance for the TWRS Mission. The following descriptions support the findings of the working group and result in isolation of the 200 areas as permanent waste storage zones.

What are the TWRS Final State Conditions?

The final state conditions of the wastes as dispositioned by the TWRS are described below. Based on these final state conditions, cost effectiveness figures of merit (see TWRS implementing procedure, "Systems and Cost Effectiveness Planning and Analysis Procedure") will be derived utilizing the Measures of Success (Table 3) related to each of the TWRS end states. To determine the desired or optimized system effectiveness, quantified technical performance measures will be developed and utilized to determine how well the system is performing with respect to the documented measures of success for each end state. Parameters which could influence the system effectiveness include availability, maintainability, reliability, risk, performance, and operating conditions.

Table 3. Measures of Success Based on TWRS End States

TWRS Acceptable End State	Measure of Success
Closed Immobilized LLW Sites	All Immobilized LLW will be disposed of onsite by September 2032.
Closed DSTs	28 DSTs will be closed by September 2034.
Closed SSTs	149 SSTs will be closed by September 2024.
Closed MUSTs	36 MUSTs owned by TWRS as of October 1995 will be closed by September 2024.
Immobilized HLW	Volume of Immobilized HLW transferred to a geologic repository by September 2041.
Cesium and Strontium Capsules	Volume of cesium and strontium capsules packaged and transferred to a geologic repository by September 2028.
Gaseous Effluents	Volume of untreated gaseous effluents released to the environment (TBD) as result of resolving Issue 12.
Liquid Effluents	Volume of released, non-compliant liquid effluents (TBD) as result of resolving Issue 12.
Solid Waste	All Solid Waste transferred to the solid waste mission area by September 2033.
Excess Facilities	All excess facilities transferred to the environmental remediation mission area by September 2033.
Beneficial Materials, Reusable Materials, and Technology Transfer	Number and/or Volume of items transferred to the Hanford Site in support of the Site Mission, or transferred external to the Hanford Site in support of other Missions by September 2033.
Ancillary Tank Farm Facilities	All ancillary tank farm equipment prepared for closure by September 2024.

Closed Immobilized LLW Sites

Immobilized LLW will be disposed onsite in approved land disposal facilities. The waste must meet DOE Order 5820.2A, Section III requirements, "Management of Low-Level Waste."

Appendix A, Table A-3 contains a summary of the regulatory requirements for wastes disposed onsite. These include requirements applicable to an engineered surface barrier for the 200 Area waste site.

Closed DSTs

TWRS is responsible for DST closure (See Issue #4) through their associated operable unit.

The DSTs are classified as active treat, store, and dispose facilities and therefore must be clean-closed in accordance with Washington Administrative Code (WAC) 173-303-610. Appendix A, Table A-4 contains specific requirements pertaining to the closure of DSTs.

Closed SSTs

TWRS is responsible for SST closure (Wagoner 1994) (See Issue #5) through their associated operable unit.

The *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology, et al., 1994) (M-45-00) specifies that closure will follow retrieval of as much tank waste as technically possible, with tank waste residues not to exceed 10.2 m^3 (2.7 kgal) in each of the 100 series tanks, 0.85 m^3 (.22 kgal) in each of the 200 series tanks, or the limit of waste retrieval technology capability, whichever is less. This represents 1% of the existing SST waste. Additionally, the SSTs will be closed in accordance with WAC-173-303-610.

The *Single-Shell Tank Closure Work Plan*, Rev. 1 (DOE/RL 1995) provides an overview of the current SST closure strategy. Appendix A, Table A-5 contains specific requirements pertaining to the closure of SSTs.

Closed MUSTs

Closure of the TWRS-assigned MUSTs is the responsibility of the TWRS through their associated operable unit.

The TWRS MUSTs supporting SST operations are included in SST operable units as ancillary equipment, and will be included in SST closure (See Issue #6). Appendix A, Table A-5 contains specific requirements pertaining to SSTs, which are also applicable to the closure of MUSTs. The TWRS MUSTs supporting DST operations included in DST operable units as ancillary equipment will be included in DST closure (see Issue #6). Appendix A, Table A-4 contains specific requirements pertaining to DSTs, which are also applicable to the closure of MUSTs.

Immobilized HLW and TRU Waste

Waste previously categorized as TRU Waste will be classified and treated as HLW (Taylor 1996) HLW will be disposed in an isolated deep geologic repository. The repository at Yucca Mountain is the proposed location for Hanford Site HLW.

The waste acceptance requirements for the immobilized HLW transferred to the Office of Civilian Radioactive Waste Management (OCRWM) are contained in DOE-OCRWM (1993). Appendix A, Table A-6 contains specific requirements applicable to the immobilized HLW. Appendix A, Table-A-7 contains the acceptance requirements for the WIPP.

Cesium and Strontium Capsules

The cesium and strontium capsules will be decontaminated, dispositioned, and stored until ready for shipment to the federal repository.

The chemical form and packaging of the cesium and strontium must comply with the requirements of the federal repository (See Open Issue 11). Appendix A, Table A-8 lists more specific requirements for repository waste acceptance (DOE-OCRWM 1993).

Gaseous Effluents

TWRS will release gaseous effluents to the environment after appropriate treatment and monitoring.

The release of nonradioactive air pollutants are regulated under the authority of Ecology primarily through WAC 173-400 and WAC 173-460. The release of radioactive air pollutants is regulated under federal code 40 CFR 61. Appendix A, Table A-9 lists specific requirements for gaseous effluents.

Liquid Effluents

TWRS will discharge liquid effluents to the effluent treatment facility (ETF) for treatment and disposition. The liquid effluent must meet the ETF acceptance criteria. Appendix A, Table A-10 lists specific requirements for liquid effluents (McDonald 1994).

Solid Waste

TWRS will transfer solid waste to the solid waste mission area for final disposition. The solid waste must meet the acceptance criteria. Appendix A, Table A-11 lists specific requirements for the disposition of solid waste (Willis et al. 1991).

Excess Facilities

TWRS will D&D and close or transfer closure ready excess facilities to the environmental remediation mission area. HLW and stored hazardous materials should be removed by the operator as part of the last operational activities prior to entering into the decommissioning phase (DOE Order 5820.2A, Chapter V). Requirements applicable to excess facilities will be developed in the future.

Beneficial Materials, Reusable Materials, and Technology Transfer

Any materials and equipment used by TWRS to accomplish the mission that is no longer needed will be made available for external beneficial use. Any material or equipment transferred must meet applicable Environment, Safety, and Health (ES&H) regulations and proper custodial transfer must be carried out.

Ancillary Tank Farm Facilities

All ancillary tank farm equipment (e.g., pipelines, vaults, etc.) will be prepared for closure (See Issues # 3, 4, and 5).

WHAT ARE THE TWRS PROGRAM ISSUES AND ASSUMPTIONS?

An issue at the mission analysis level is an unsettled matter that cannot be resolved internally within TWRS. Resolution of these issues will further define or clarify the TWRS mission. Assumptions associated with technology, regulations, required resources, and future conditions are made as necessary to support planning, both long-range and short-range. Planning must include validating all assumptions. For the Mission Analysis Report, the key open issues and associated planning assumptions are discussed below. These issues will be tracked, evaluated, and resolved using a risk management watch list.

All of the Issues identified below are considered critical and of high risk to completion of the TWRS mission. The enabling assumptions identify a means to proceed with the mission at some additional risk. All of the issues and related enabling assumptions have been entered into the Programmatic Risk Information Management System (PRIMS). Appendix E provides examples of the PRIMS printout. These issues and assumptions will be tracked and resolved by means of the TWRS Risk and Decision Management procedures.

ISSUE 1

Federal regulations require that the residual HLW wastes be removed for disposal elsewhere, or be subject to NRC's licensing authority if disposed in place. What tank waste can be classified as non-HLW and not require a NRC-licensed disposal facility? Should this waste classification be established?

ENABLING ASSUMPTION:

The NRC will classify residual waste remaining in tank farms after retrieval as non-HLW. Develop the technical bases for classifying portions of the waste as non-HLW per the NRC criteria. Discuss with NRC and stakeholders, and request NRC concurrence.

ISSUE 2

What radionuclide content can remain in the treated low-activity waste fraction from SSTs and DSTs, and disposed onsite for the NRC to concur it is not HLW subject to its regulatory jurisdiction?

ENABLING ASSUMPTION:

The residual waste after treatment is assumed to be classified as incidental waste based on the NRC's previous ruling for DST wastes. The NRC defined incidental waste as: 1) waste that has been processed (or will be further processed) to remove key radionuclides to the extent that is technically and economically practical; 2) waste that will be incorporated into a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C LLW as set out in 10 CFR 61; and 3) waste that will be managed, pursuant to the AEA, such that safety requirements comparable to the performance objectives set out in 10 CFR 61 are satisfied.

ISSUE 3

How much waste should be removed from each tank in preparation for closure?

ENABLING ASSUMPTION:

The SST waste retrieval system will be capable of meeting the Tri-Party Agreement milestone requiring 99% retrieval. This will be sufficient to close tanks without further retrieval. The waste retrieval systems for MUSTs and DSTs will be comparable to that for SSTs. Also, closure requirements for DSTs will be similar to requirements for SSTs. The TWRS MUSTs are included in SST operable units as ancillary equipment, and will be included in SST closure.

ISSUE 4

Uncertainty exists with respect to disposition of DST structures; may be closed by TWRS or ER Program (DOE/RL 1993).

ENABLING ASSUMPTION

TWRS is responsible for DST closure.

ISSUE 5

A recent EM-30 and EM-40 Memorandum of Agreement (MOA) (Wagoner 1994) (DOE/RL 1995) was signed to turn over responsibility for SST closure and soils remediation to EM-30. The TWRS Program is currently awaiting formal direction from RL regarding this MOA.

ENABLING ASSUMPTION

SST closure is the responsibility of TWRS.

ISSUE 6

There are 63 MUSTs and special facilities currently identified in Powers (1995), Rymarz and Speer (1991), and Nielsen (1992). Additional MUSTs may be identified. It is necessary to finalize program responsibility for these tanks. Initial DOE program assignment of these tanks (Powers 1995) designated that TWRS had responsibility for 36 inactive tanks.

ENABLING ASSUMPTION

TWRS will be responsible for closure of all MUSTs falling under TWRS ownership (36 as of October 1995).

ISSUE 7

Will the OCRWM accept a HLW form that is different than that produced by the Defense Waste Processing Facility (DWPF) and West Valley Demonstration Project (WVDP)?

ENABLING ASSUMPTION:

The Hanford HLW form will be acceptable to the OCRWM if it meets or exceeds the performance of the standard waste form (borosilicate glass).

ISSUE 8

Will the OCRWM accept a HLW canister configuration that is different from DWPF and WVDP?

ENABLING ASSUMPTION:

The OCRWM will accept a larger canister.

ISSUE 9

What is an acceptable volume of HLW produced for offsite disposal?

ENABLING ASSUMPTION:

23,000 standard canisters of HLW will be produced, based upon an independent technical review. This value is to be used "as the technical baseline for future work," (Kinzer 1996). An evaluation of enhanced sludge washing will be completed by March 1998. This evaluation will assess the acceptability of the volume of HLW produced.

ISSUE 10 - DELETED

ISSUE 11

Are the respective cesium and strontium halide salts acceptable waste forms for disposal in a geologic repository? If so, what is an acceptable packaging configuration for disposal of these currently metal encapsulated salts? Is it technically and economically more practical to pursue repository disposal of the capsules directly or to blend the capsule contents with other TWRS HLW streams and then dispose of the vitrified product in the repository?

ENABLING ASSUMPTION:

The dispositioned cesium and strontium capsules will be overpacked or incorporated into the HLW glass and sent to the Federal geologic repository as HLW for final disposal.

ISSUE 12

What are the dose or concentration limits for radionuclides and chemicals allocated to TWRS from the site allowable limits?

ENABLING ASSUMPTION

An acceptable method to allocate fractions of the sitewide dose or concentration limits to each of the programs will be developed as part of the composite analysis to be performed as part of the Defense Nuclear Facility Safety Board workscope (Fiscal Year 1997).

ISSUE 13

What is the path forward for future uses of the Hanford Site, and specifically for those areas under direct TWRS responsibility?

ENABLING ASSUMPTION

The findings of the Hanford Future Site Uses Working Group, presented in the April 1992 document "The Future for Hanford: Uses and Cleanup," will be used as guidance for the path forward.

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APPENDIX A
TWRS STAKEHOLDER VALUES

*1. Protect Public/worker Health and Safety
2. Transport Waste Safely and be Prepared
*3. Protect the Environment
*4. Protect the Columbia River
5. Deal Realistically and Forcefully with Groundwater
6. Do No Harm During Cleanup or with New Development
7. Use the Central Plateau Wisely for Waste Management
8. Cleanup Areas of High Future Use Value
*9. Cleanup to the Level Necessary to Enable Future Use Options to Occur
*10. Capture Economic Development Opportunities Locally
11. Involve the Public in Future Decisions about Hanford
12. Establish Management Practices that Ensure Accountability, Efficiency, and Allocation of Funds to High Priority Items
13. Get on with the Cleanup to Achieve Substantive Progress in a Timely Manner
14. Use a Systems Design Approach that Keeps End Points in Mind as Intermediate Decisions are Being Made
*15. Protect Rights of Native American Indians
*16. Ensure Compliance
*17. Reduce Cost
18. Improve Waste Management
19. Use Mature Technologies
20. Enhance Public Acceptance
21. Use Open and Fair Processes
22. Increase Efficiency
*23. Enhance Technology Development

*Note: The TWRS stakeholder values listed above were reduced to nine (9) items identified by an asterisk and listed in Table A-1 (Armacost et al. 1994).

Armacost, L.L., D. von Winterfeldt, J. Creighton, M. Robershotte, *Public Values Related to Decisions in the Tank Waste Remediation System Program*, PNL-10107, 1994, Pacific Northwest Laboratory, Richland Washington

Table A-1. Quantification of Stakeholder Values.

Associated Stakeholder/Customer Value	Relevant TWRS Issues	Mission Objectives	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing relevant requirements or regulations	Requirement Verification Methodology
1. Protect Public/Worker Health and Safety	- Issue 3 How much waste should be removed from each tank in preparation for closure? - Issue 3 What tank waste can be considered non-HLW - Issue 4 What radionuclide content can remain in the treated low-activity waste fraction disposed onsite	-Minimize risk of cancer incidences due to exposure of radioactive tank material -Minimize worker lives lost due to construction/ operations and radioactive exposure -Minimize lost time accidents	- TWRS allocation of dose requirements based on sitewide performance assessment -LLW waste disposal performance assessment program results -Tank closure performance assessment results -Risk Assessment Project Results (Buck et al. 1995 and Boothe 1995) -Projected number of workers necessary to operate newly designed processing facilities -Projected radionuclide activity per acre of land -TWRS EIS	-Time series of contaminant concentration measurements from all contamination monitoring sites, onsite and offsite -Worker fatalities or injuries for construction/operations -Number of latent local cancer fatalities and incidences	10 CFR 61.41 10 CFR 61.56 10 CFR 835 29 CFR 1910 40 CFR 61.92 40 CFR 191.03 DOE 5480.11 DOE 5400.5 -Retrievability of immobilized LLW waste Packages -DOE 5820.2A	Analysis

Table A-1. Quantification of Stakeholder Values.

Associated Stakeholder/Customer Value	Relevant TWRS Issues	Mission Objectives	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing relevant requirements or regulations	Requirement Verification Methodology
2. Protect Environment	- Issue 3 How much waste should be removed from each tank in preparation for closure? - Issue 2 What radionuclide content can remain in the treated low-activity waste fraction disposed onsite	-Minimize land acreage totally restricted due to waste remediation -Minimize number of plants/animals destroyed or adversely affected	-Number of acres planned for use by new processing facilities -Projections of Effluent release volumes and concentrations -Radionuclide inventories in buried onsite wastes - Number of acres for disposal of solid waste and LLW -Capital costs for ETF -Tank closure PA results -TWRS EIS -LLW Disposal PA	-TWRS effluent contamination levels as sent to the ETF -Cumulative amount of land made restrictive to future use -Measures of soil fertility -Number of animal/plants adversely affected	-Effluent Treatment Facility (ETF) effluent acceptance standards -40 CFR 61.92 -40 CFR 50.4 -40 CFR 50.5 -40 CFR 50.6 -40 CFR 50.8 -40 CFR 50.9 -40 CFR 50.11 -40 CFR 50.12 -40 CFR 141	Analysis Inspection

Table A-1. Quantification of Stakeholder Values.

Associated Stakeholder/Customer Value	Relevant TWRS Issues	Mission Objectives	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing relevant requirements or regulations	Requirement Verification Methodology
3. Protect the Columbia River	- Issue 2 What radionuclide content can remain in the treated low-activity waste fraction disposed onsite - Issue 3 How much waste should be removed from each tank in preparation for closure?	-Minimize effluent discharge volumes and contamination levels	-Projections of liquid effluent release volumes and concentrations -Drinking water consequence values from LLW performance assessment -Projected amounts of radionuclides processed annually -Total amount of radionuclides disposed of in central plateau -Capital costs for ETF -Tank closure PA results	-Concentrations of radionuclides at site wells and at locations in the river -Number of fish casualties and their contamination level	- 40 CFR 141 - Accepted Effluent discharge standards -WAC 173-200	Analysis Inspection

Table A-1. Quantification of Stakeholder Values.

Associated Stakeholder/Customer Value	Relevant TWRS Issues	Mission Objectives	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing relevant requirements or regulations	Requirement Verification Methodology
4. Cleanup to the Level Necessary to Enable Future Options to Occur	- Issue 2 What radionuclide content can remain in the treated low-activity waste fraction disposed onsite - Issue 3 How much waste should be removed from each tank in preparation for closure?	-Minimize contamination levels at mission end -Maximize percentage of land cleaned up to industrial, recreational, and residential standards	- Projected amount of unrestricted land available for future use - Projected amount of radionuclides disposed of in central plateau -Tank closure PA results -LLW Disposal PA		- All applicable ES&H requirements must be met at site of future use -Applicable barrier, boundary access control, and intrusion protection requirements must be met - See Immobilized LLW waste disposal site closure requirements in Final State Section	Analysis

Table A-1. Quantification of Stakeholder Values.

Associated Stakeholder/Customer Value	Relevant TWRS Issues	Mission Objectives	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing relevant requirements or regulations	Requirement Verification Methodology
5. Capture Economic Development Locally	- Program for redirected use of beneficial materials and equipment outside of cleanup mission	-Maximize number of new enterprises, businesses, or industries started by local individuals or groups -Make local economy less dependent upon government funded activities	- Projected amount of fully unrestricted land	-Annual profits or revenues of businesses non-related to Hanford cleanup activities	-Ideas (no accepted requirements yet) - Non-Hanford business revenues must be kept at a certain level - Number of new non-Hanford businesses per unit of time must meet a certain level	Inspection
6. Protect Rights of Native American Indians		-Maximize unrestricted land available to Indians	- Projected amount of land unrestricted to future indian use	-Cumulative acres available to Indians -Number of disturbed religious or archeological sites	-DOE 1230.2 Indian Policies	Inspections
7. Ensure Compliance		-Maximize number of regulations in full compliance of -Maximize public acceptance	- Degree that proposed alternatives are designed or projected to meet major requirements	-Number of requirements not met or in compliance with	-All identified applicable requirements and regulations	Inspections Analysis Tests
8. Enhance Technology Development (use practical, available, timely technology)		-Reduce program risk associated with unproven technology by utilizing the most practical and available technology	-Number of instances of prior successful applications or adaptations of technology	-Successful adaptation of technology in retrieving, processing, and disposing waste	-Optimize cost and schedule risk	Analysis Tests

Table A-1. Quantification of Stakeholder Values.

Associated Stakeholder/Customer Value	Relevant TWRS Issues	Mission Objectives	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing relevant requirements or regulations	Requirement Verification Methodology
9. Reduce Cleanup Costs	-Open Issue 14 Can transuranics (TRU) be sent to the Waste Isolation Pilot Plant (WIPP) - Open Issue 12 Will different HLW packaging forms (larger canisters) be accepted at the repository	- Minimize total program costs	- Cost Projections (Discounted) for different alternatives - Overall system cost and performance efficiency - Projections of repository costs	-Cost savings at completion of major cleanup milestones -Annual TWRS mission cost profiles -Repository costs	- Multi-Year Program Plan or document identifying cost impacts (See cost profiles) -TWRS must meet overall system operating and cost efficiency values	Analysis

Table A-2. Quantification of Mission Objectives.

Associated Mission Goals	Relevant TWRS Open Issues	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing Relevant Requirements or Regulations	Requirement Verification Methodology
Operate and maintain facilities to provide continued safe and environmentally sound storage	-Tank and facility contaminant monitoring systems -Tank characterization status and data quality -Overall TWRS total operating efficiency and maintainability	-Degree at which proposed alternatives rely on existing facilities -Estimated cost of necessary tank farm infrastructure upgrades for given alternatives -Estimated total operating efficiency for different alternatives	-Amount of operating costs needed for maintaining the TWRS in a safe condition -Number of safety issues mitigated -Overall TWRS total operating efficiency	- tbd Requirements dependent upon chosen architectures	Analysis Testing

Table A-2. Quantification of Mission Objectives.

Associated Mission Goals	Relevant TWRS Open Issues	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing Relevant Requirements or Regulations	Requirement Verification Methodology
Retrieve tank waste	- Issue 3 How much waste should be removed from each tank in preparation for closure? -Selected retrieval architecture -Selected retrieval schedule and sequence -Waste blending strategy	-Past practice and projected waste retrieval rates -Total operating efficiency (TOE) for retrieval -Tank closure PA results	-Instantaneous and time-average waste retrieval rates -Total operating efficiency (TOE) for retrieval	-Time average retrieval rate SST: 9760 m^3/year (14 year retrieval period, 136,600 m^3 waste) -Instantaneous retrieval rate driven by TPA SST retrieval schedule -SST residual waste: 10.2 m^3 for 100 series tanks and 0.83 m^3 for 200 series tanks or less (Ecology 1994) -DST residual waste: Clean close -Active MUSTs residual waste: Clean close	Analysis Testing

Table A-2. Quantification of Mission Objectives.

Associated Mission Goals	Relevant TWRS Open Issues	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing Relevant Requirements or Regulations	Requirement Verification Methodology
Pretreat Tank Wastes	-Selection of pretreatment process	-Estimated necessary waste pretreatment facility or process throughput rates -Estimated necessary waste transfers rates between processes and facilities	-Achieved pretreatment facility or process waste throughput rates -Achieved waste transfer rates -Achieved pretreatment and processing total efficiency factor	-Requirements tbd Dependent upon chosen architecture	Analysis
Immobilize and dispose of any remaining mixed or LLW	-Waste separation process -Immobilized LLW form	-Projected radionuclide and chemical separation factors -Performance assessment of immobilized LLW form buried in 200 area (component leach rates and drinking water consequences)	-Achieved waste separation factors -Achieved waste loading -Immobilized LLW volume -LLW immobilization throughput rate	-Requirements tbd Will depend on chosen architectures	Analysis Testing

Table A-2. Quantification of Mission Objectives.

Associated Mission Goals	Relevant TWRS Open Issues	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing Relevant Requirements or Regulations	Requirement Verification Methodology
Close the underground storage tanks	- Issue 3 How much waste should be removed from each tank in preparation for closure?	-Projected amount of residual SST wastes remaining for given retrieval architecture -Risk Assessment of residual wastes -Tank closure PA results	-Amount of residual SST and DST wastes -	-Tri-Party Agreement M-45-00 99 volume% waste retrieval for SST -Closed tanks must meet applicable contaminant release limits	
Immobilize high-level and transuranic (TRU) constituents of waste to minimize safety and environmental risk, and enable permanent disposal	-Waste separation process -Immobilized HLW form	-Projected HLW/LLW waste separation factors -Immobilized HLW form waste constituent loading limits -Projected pre-immobilized and immobilized HLW volume	- HLW immobilization throughput rate - Achieved waste loading in IHLW form -Quantity of immobilized waste form needing rework -Immobilized HLW volume	-Requirements tbd Will depend on chosen architectures	Analysis Testing Inspections

Table A-2. Quantification of Mission Objectives.

Associated Mission Goals	Relevant TWRS Open Issues	Decision Measures (Measures of Performance for Selection of Alternatives)	Technical Performance Measures	Existing Relevant Requirements or Regulations	Requirement Verification Methodology
Minimize waste volume disposed to lessen impact on repository and Hanford land use	-Degree of HLW/LLW waste separation -Immobilized LLW and HLW waste volumes -Degree of radionuclide and chemical contamination in immobilized LLW waste form	-Projected LLW/HLW waste separation factors -Projected immobilized HLW and LLW waste loading limits and efficiency -Projected immobilized HLW and LLW volumes -Buried onsite LLW performance assessment (leach rates, groundwater contaminant concentrations)	-Achieved HLW/LLW waste separation factors -Achieved radionuclide and chemical loading in immobilized waste form -Achieved immobilized waste form volume -Results of durability tests on immobilized waste forms	-Requirements tbd	Analysis Testing
Transfer excess facilities and equipment to the Environmental Restoration Mission Area	-Recycle of effluents back into processing system -Volatility of constituent radionuclide and chemical in waste -Addition of process materials/chemicals -Number of active facilities	-Projected volume of gaseous and liquid effluents produced by TWRS -Projected contamination levels of effluents -Percentage of effluents recycled back into primary processing system -Number of planned active facilities for alternatives	-Effluent volumes produced by TWRS -Measured contamination levels in effluent released to ETF -Capital costs for ETF -Actual number of active facilities	-Effluent Treatment Facility (ETF) acceptance requirements -Gaseous effluents discharge regulations	Analysis Testing Inspection

Table A-3. LLW Final State Requirements.

Requirement	Description	Pertinent Numeric Value
DOE Order 5820.2A, Section III	Management of low-level waste; the DOE order that establishes policies, requirements, and guidelines for managing the department's solid low-level waste	Assure that the committed effective dose equivalents received by individuals who inadvertently may intrude into the facility after the loss of active institutional control will not exceed 100 mrem/yr for continuous exposure or 500 mrem for a single acute exposure.
Bernero 1993	Requirements that key radionuclides must be removed to the extent technically and economically practical to be considered incidental waste and meet stability requirements similar to 10CFR61. Waste must be less than Class C, per 10CFR61 (Cs 4600. St 7000, TRU 100Ci/g, Tc 3.0).	Numeric values are not currently approved. Draft values may be found in Table 5-3 of *Technical Basis for Classification of Low Activity Waste Fraction from Hanford Tanks*, WHC-SD-WM-TI-699
40 CFR 241.209	Cover requirements.	•Surface grades and slopes to promote maximum run-off to avoid erosion and infiltration. •Promotions of vegetative growth. •Procedures to maintain cover material integrity.
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Applies only to hazardous waste portion of LLW
40 CFR 268	Land Disposal Restrictions (hazardous waste)	Lists wastes that are prohibited from land disposal, maximum concentrations of constituents restricted from land disposal, and applicable exceptions.
DOE Order 5820.2A	Radioactive Waste Management	Groundwater: 4 mrem/year EDE Distance from disposal: 100 meters from the edge of disposal after period of active institutional control Time period for compliance: 1,000 years Population collective dose limit: 500 person-rem/year
WAC 173-303-070	Designation of Dangerous Waste	Provides procedures for determining whether a solid waste is a dangerous waste or an extremely hazardous waste

Table A-3. LLW Final State Requirements.

Requirement	Description	Pertinent Numeric Value
WAC 173-303-283	Performance Standards	Provides general performance standards for designing, constructing, operating, and maintaining dangerous waste facilities. States that a dangerous waste facility must, to the maximum extent practical, prevent: degradation of groundwater quality, degradation of air quality, degradation of surface water quality, destruction or impairment of flora and fauna, excessive noise, negative aesthetic impact, unstable hillsides or soils, use of processes that do not recover material, endangerment of the health of workers and public.
WAC 173-303-610	Closure and post-closure	
WAC 173-303-645	Releases from Regulated Units	Table 1 of section (4) provides maximum groundwater concentration limits for various constituents
WAC 173-303-650	Surface Impoundments	•Provide long-term minimization of the migration of liquids through the closed impoundment with a material that has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
WAC 173-303-665	Landfill Requirements	Specifies requirements for landfill construction and monitoring, including requirements for liners and covers.
WAC 173-303-806	Final Facility Permits	Specifies detailed requirements for the information to be contained in Final Facility permits.
All previously stated ES&H in external mission driven regulations apply.		

Table A-4. Requirements Identified for Closed Double-Shell Tanks (DOE/RL 1995).

Requirement	Description	Pertinent Numeric Value
WAC 173-303-610	Requirements related to active treat, store, and dispose (TSD) facilities.	• Clean closure requirements
WAC 173-303 070	Designation of dangerous waste	tbd
WAC 173-303-283	Performance standards	tbd
WAC 173-303-645	Releases from regulated units	tbd
40 CFR 191 Part B	Disposal of transuranics (TRU) and HLW - Total release from facility, individual protection limits, and a groundwater protection standard. Reissued 12/93 by the EPA (58 FR 66398). Applies if SST tank residuals are considered to be TRU or HLW.	• Individual Protection limits (effective dose equivalent per year) 15 mrem/year (25 mrem/year organ) • Drinking Water Protection 4 mrem/year for beta/gamma emitters and maximum concentration limits (MCL) for alpha emitters (applies for 10,000 years)
10 CFR 835	Occupational radiation protection - radiation workers	5 rem year Modifications for special cases
DOE Order 5820.2A	Groundwater performance objective, definition of the point of compliance, a limit on the time period for compliance, and a long-term protection requirement expressed as a population collective dose limit.	Groundwater 4 mrem year EDE Distance from disposal 100 meters from edge of disposal after period of active institutional control Time period for compliance 1,000 years Population collective dose limit 500 person-rem/year
40 CFR 61 series	Limits on hazardous air pollutants.	See Table B-1.

Table A-5. Requirements Identified for Closed Single-Shell Tanks (DOE/RL-89-16).

Requirement	Description	Pertinent Numeric Value
10 CFR 835	Occupational radiation protection - radiation workers	5 rem year Modifications for special cases
DOE 5820.2A	Groundwater performance objective, definition of the point of compliance, a limit on the time period for compliance, and a long-term protection requirement expressed as a population collective dose limit.	Groundwater 4 mrem year EDE Distance from disposal 100 meters from edge of disposal after period of active institutional control Time period for compliance 1,000 years Population collective dose limit 500 person-rem/year
40 CFR 61 series	Limits on hazardous air pollutants.	40 CFR 50 (See Table B-1). WAC 173-400 WAC 173-460

Table A-6. HLW Final State Requirements.

Requirement	Requirement Classification or Citing	Pertinent Values
HLW Standard Form	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	Borosilicate Glass[1]
Total Length	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	3.0 m (+0.005, -0.020)[1]
Canister Diameter	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	61.0 cm (+1.5,-1.0 cm)[1]
Maximum Weight	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	2500 kg
Canister Fill Height	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	at least 80% of empty canister
Maximum Total Heat Generation	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	1500 watts/canister at year of shipment
Maximum Storage Temperature	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	400° C
Maximum Inert Cover Gas Leak Rate	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.2	10^{-4} atm-cc/sec.
Canister shall be labelled with unique alphanumeric identifier	10 CFR 60.135(b)(4)	
Criticality Safety	10 CFR 60.131(b)(7) 10 CFR 71.55	Criticality is not possible unless two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety: k_{eff} sufficiently less than 1 with at least 5% margin after allowance for bias in method of calculation, and uncertainty of experiments used to validate measurement method
Chemical Composition	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.6	DOE/OCRWM requires chemical composition and crystalline phase projections for the waste form DOE/OCRWM requires oxide compositions for the oxides of elements present in concentrations > 0.5 weight %, and estimate of error.

Table A-6. HLW Final State Requirements.

Requirement	Requirement Classification or Citing	Pertinent Values
Canister Material	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.7	DOE/OCRWM requires the ASTM alloy specification and composition of the fill canister material
Radionuclide Inventory	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.8	DOE/OCRWM requires estimates of total and individual canister inventory of radionuclides (in Curies) with half lives > 10 years and are or will be present in concentrations > 0.05% of the total radioactive inventory. The estimates shall be indexed to the year 2015
Hazardous Waste Determination	Waste Acceptance System Requirements Document DOE/RW-0351P, 3.7.1.2.1.12	
Land Disposal Restrictions	10 CFR 148	

[1] Other Standard HLW forms and canisters will be defined in subsequent revisions of the Waste Acceptance System Requirements Document

Table A-7. Waste Isolation Pilot Plant (WIPP) Acceptance Requirements.

Requirement	Description	Pertinent Numeric Value
49 CFR 173.412	Waste Packaging Requirements	Type A Package
WIPP-069 Rev 4 3.2	Waste concentrations distinguishing remote handled (RH) and contact handled (CH)	Remote handled > 200 mrem/hr at container surface Contact handled < 200 mrem/hr at container surface
WIPP-069 Rev 4 3.2.2	Remotely Handled (RH) TRU Waste Canister Size	• Nominal Diameter 0.66 m
WIPP-069 Rev 4 3.2.2.6	Contact Handled (CH) TRU waste package size	• Standard 55 gallon drum • Various rectangular metal box sizes
WIPP-069 Rev 4 3.3.2	Limits for accepted amount of liquid wastes	• Maximum of 1 volume% liquid for TRUPACT-II
WIPP-069 Rev 4 3.3.3	Limits for pyrophoric radionuclides	• Maximum of 1 weight% polyphoric radionuclides
WIPP-069 Rev 4 3.4.2	Contact handled weight limits for fissile or fissionable radionuclide contents - in Pu-239 fissile-gram	• 200 g per 55-gallon drum • 500 g DOT 6M container • 5 g per cubic foot in boxes, • 350 g max per box
WIPP-069 Rev 4 3.4.2	Remote Handled weight limits for fissile or fissionable radionuclide contents (Pu-239 FGE)	• Max limit 600 g total

Table A-7. Waste Isolation Pilot Plant (WIPP) Acceptance Requirements.

Requirement	Description	Pertinent Numeric Value
WIPP-069 Rev 4 3.4.3	Plutonium-239 activity limits	• Packages shall not exceed 1000 Ci of Pu-239 equivalent activity
WIPP-069 Rev 4 3.4.4	Remote handled TRU package surface dose rates	• Surface Dose rate shall not exceed 1,000 rem/hr • Neutron contributions limit 270 mrem/hr • 95% of RH canisters shall have does rates < = 100 rem/hr • No more than 5% of canisters are allowed to have < = 1,000 rem/hr
WIPP-069 Rev 4 3.4.6	RH-TRU waste package thermal requirements	• Thermal power shall not exceed 300 watts

Table A-8. Dispositioned Cesium and Strontium Capsule Requirements.

Requirement	Requirement Classification or Citing	Pertinent Values
Radioactive Waste Classification	DOE 5820.2A	
Hazardous Waste Definitions	40 CFR 261 Subparts C and D	
Criteria for the Waste Package and its Components	10 CFR 60.135	General requirements concerning explosive, pyrophoric, and chemically reactive packages, free liquids, handling, unique identification, solidification, and combustibles.

Table A-9. Gaseous Effluents Discharge Requirements.

Requirement	Description	Pertinent Numeric Value
WAC 173-400	Ambient air quality standards and applicable regulations	See regulation
WAC 173-460	Toxic Air Pollutants	See Regulation
40 CFR 50	Federal Ambient air quality standards	See table B-1
40 CFR 61, Subpart H	National Emission Standards for Hazardous Air Pollutants, General Provisions	See Regulation
40 CFR 61.92	Dose limits of ambient air emissions from DOE facilities	Public dose limit Effective dose equivalent 10 mrem/year

Table A-10. Liquid Effluents Acceptance Criteria.

Requirement	Description	Pertinent Numeric Value
WHC-SD-ETF-WAC-001 Rev. 0	Characterization	The waste stream must be characterized to degree established in RCRA Part B permit
WHC-SD-ETF-WAC-001 Rev. 0	TRU limits	TRU concentration limit 100 nCi/g
WHC-SD-ETF-WAC-001 Rev. 0	Types of waste accepted	Only waste codes listed in the Delisting Petition and the RCRA permit can only be accepted
WHC-SD-ETF-WAC-001 Rev. 0	Organics	No separable organics. UV/OX concentrations do not exceed 100 to 300 ppm
WHC-SD-ETF-WAC-001 Rev. 0	Colloidal matter	Minimize colloidal matter to protect filters
WHC-SD-ETF-WAC-001 Rev. 0	Scale forming compounds	Minimize scale forming compounds (eg .calcium sulfate, calcium phosphate, and metal silicates) Max silicate concentrations 0.001 molar Max influent dissolved solid concentration 500 ppm
WHC-SD-ETF-WAC-001 Rev. 0	Corrosive Constituents	Max concentrations limits for floride and chloride.

Table A-11. Solid Waste Acceptance Criteria.

Requirement	Description	Pertinent Numeric Value
LLW Solid Waste Acceptance Criteria		
WHC-EP-0063-3	Radionuclide concentration limits	**Category 1 Category 3** H-3 5.0 Ci/m^3 Co-60 300 Ci/m^3 Ni-63 2.0 Ci/m^3 700 Ci/m^3 Ni-63* 20 Ci/m^3 7000 Ci/m^3 Sr-90 0.005 Ci/m^3 7000 Ci/m^3 Nb-94 8e-4 Ci/m^3 0.2 Ci/m^3 Tc-99 7e-3 Ci/m^3 3.0 Ci/m^3 I-129 1e-3 Ci/m^3 8e-2 Ci/m^3 Cs-137 2e-2 Ci/m^3 4.6e3 Ci/m^3 Pu-241 50.0 nCi/g 3.5e3 nCi/g Cm-242 2.e3 nCi/g 2.0e4 nCi/g Se-79 7e-3 Ci/m^3 7.e-2 Ci/m^3 Alpha emitters > 5 year t_h 10 nCi/g 100 nCi/g *-Activated metal Higher concentrations go to repository
WHC-EP-0063-3	Containment	All LLW waste packages shall provide double containment except as specified in applicable SDAR
WHC-EP-0063-3	Surface Dose Rates	CH waste package limits 200 mrem/hr surface for 1 marked pt 1000 mrem/hr with approval from SWEA RH waste package limits 3000 mrem/hr at 1 m on truck 5000 mrem/hr at 1 m from side of railcar Waste packages inside returnable overpacks limit of 100 mrem/hr to personnel during work Packages sent to CWC 100 mrem/hr at any point
WHC-EP-0063-3	Surface Contamination	Exterior surfaces 220 dpm/100 cm^2 for alpha 2200 dpm/100 cm^2 for beta/gamma
WHC-EP-0063-3	Thermal Power limits	Greater than 0.1 W/ft^3 shall be included in SDAR application
WHC-EP-0063-3	Interior void space	Void space shall not exceed 10 internal volume %.

Table A-11. Solid Waste Acceptance Criteria.

Requirement	Description	Pertinent Numeric Value
WHC-EP-0063-3	Nuclear criticality	Waste packages with greater than 15 g of U-235 will be accepted on a criticality analysis basis

APPENDIX B

Table B-1. Tank Waste Remediation System Externally Imposed Requirements.

External Code or Regulation	Description	Pertinent Numeric Values
Code of Federal Regulations		
10 CFR 61.41	Protection of the general population from releases of radiation. Equivalent annual dose limits for public exposure to contaminated groundwater, surface water, air, soil, plants, and animals	Limits (annual dose) • Body: 25 mrem • Thyroid: 75 mrem • Any other critical organ: 25 mrem or ALARA
10 CFR 61.42	Protection of individuals from inadvertent intrusion	N/A
10 CFR 61.52	Burial requirements for Class A and Class C Wastes - Specifies pertinent onsite immobilized LLW burial requirements	Class C Waste: • Minimum 5 meters or deeper below surface or • 500 year intrusion barrier
10 CFR 61.55	Classification of Wastes - Classification specifications for Class A and Class C wastes. Designates whether immobilized wastes may be in general buried onsite or if it is necessary to dispose of in an isolated deep repository	Class C waste: Long Lived • C 14 0.8 to 8 Ci/m^3 • C 14* 8 to 80 Ci/m^3 • Ni 59* 22 to 220 Ci/m^3 • Nb 94* 0.02 to 0.2 Ci/m^3 • Tc 99 0.3 to 3. Ci/m^3 • I 129 0.008 to 0.08 Ci/m^3 • α emitters TRU, t_h > 5 yrs 10 to 100 nCi/g • Pu 241 350 to 3,500 nCi/g • Cm 242 2,000 to 20,000 nCi/g Short Lived • H 3 Determined by heat • Co 60 Determined by heat • Ni 63 70 to 700 Ci/m^3 • Sr 90 150 to 7,000 Ci/m^3 • Cs 137 44 to 4,600 Ci/m^3 Lower Concentrations: Class A Higher Concentrations: Must go to geologic repository *Inactivated metal
10 CFR 61.56	Minimum Requirements for all class of waste and are intended to facilitate handling at the disposal site and provide protection of health and safety of personnel at the disposal site	Liquid may not exceed 0.5 volume % in waste packaged for stability. For Class C wastes void space, no gas generation, waste stability, non-pyrophoric, non-reactive.
10 CFR 830.120	Quality Assurance Requirements Applicable to: Quality Assurance Program, Personnel Training, Quality Improvement	N/A

Table B-1. Tank Waste Remediation System Externally Imposed Requirements.

External Code or Regulation	Description	Pertinent Numeric Values
10 CFR 835.202	Occupational exposure limits for general employees	Annual limits • Total effective dose 5 rems • Sum of deep dose equivalent and the committed dose equivalent to any organ or tissue other than lens of eye 50 rems • Lens of eye dose equivalent 15 rems • Shallow dose equivalent to skin or any extremity 50 rems
10 CFR 962	DOE obligation to RCRA - Defines DOEs obligations to the Resource Conservation and Recovery Act of 1976 with regard to radioactive waste substances	N/A
29 CFR 1910	Occupational Safety and Health Standards (OSHA) regulations	
40 CFR 50.4	Ambient air quality standards - primary limits for sulfur oxides	Annual arithmetic mean 80 $\mu g/m^3$ (0.03 ppm) Maximum 24 hour concentration not to be exceeded more than once per year 365 $\mu g/m^3$ (0.14 ppm)
40 CFR 50.5	Ambient air quality standards - secondary limits for sulfur oxides	Maximum 3 hour concentration not to be exceeded more than once per year 1,300 $\mu g/m^3$ (0.5 ppm)
40 CFR 50.6	Ambient air quality standards - primary and secondary limits of particulate matter	Annual arithmetic mean 50 $\mu g/m^3$ Maximum 24-hour average concentration 150 $\mu g/m^3$ Measured in accordance with PM10 (particles with aerodynamic diameters of less than or equal to a nominal 10 μm)
40 CFR 50.8	Ambient air quality standards - primary limits for carbon monoxide	Maximum 8-hour average concentration not to be exceeded more than once per year 9 ppm (10 mg/m^3) Maximum 1-hour average concentration not to be exceeded more than once per year 35 ppm (40 mg/m^3)
40 CFR 50.9	Ambient air quality standards - primary and secondary limits for ozone	Maximum 1 hour average concentration. 0.12 ppm (235 g/m^3) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm (235 g/m^3) is equal to or less than 1
40 CFR 50.11	Ambient air quality standards - primary and secondary for nitrogen dioxide	Annual arithmetic mean primary 0.053 ppm (100 $\mu g/m^3$) Secondary is same

Table B-1. Tank Waste Remediation System Externally Imposed Requirements.

External Code or Regulation	Description	Pertinent Numeric Values
40 CFR 50.12	Ambient air quality standards - primary and secondary standards for lead (Pb)	Max arithmetic mean averaged over calendar year quarter 1.5 $\mu g/m^3$
40 CFR 61.92	Dose limit from DOE facility. Emissions to ambient air from DOE facilities shall not exceed to any member of the public in one year	Effective dose equivalent 10 mrem/year or ALARA
40 CFR 141	National Primary Drinking Water Regulations	Effective dose equivalent 4 mrem/year
40 CFR 264.194(a)	Storage requirements - Hazardous wastes must not be placed in tank system if they could cause the tank or associated ancillary equipment, and containment system to rupture, leak, corrode, or otherwise fail	
40 CFR 264.194(b)	Storage requirements - The owner or operator must use appropriate controls and practices to prevent spills and overflows from tank to containment systems	
40 CFR 264.198	Storage requirements - Ignitable or reactive waste must not be placed in tank systems, unless: (1) The waste is treated, rendered, or mixed so that the waste is protected from a material or condition that may cause the waste to ignite or react or 40 CFR 264.17(b) is complied with, or (2) the tank system is used solely for emergencies. Stored ignitable or reactive wastes must comply with requirement for protective distances from the public	
40 CFR 264.199	Storage requirements - Incompatible wastes, or incompatible wastes and materials must not be placed in same tank system, unless 40 CFR 264.17(b) is complied with	
40 CFR 264.1102	Closure requirement - Decontamination at closure of a containment building. Owner/operator must decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste and leachate, and manage as a hazardous waste	
40 CFR 264.178	Waste containment system closure requirements. At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or residues must be decontaminated or removed	N/A
40 CFR 191.03	Public dose limits. Management and storage of spent nuclear fuel, high-level, or TRU radioactive wastes annual dose equivalents to any member of the public in the general environment. Discharges of radioactive material and direct radiation shall not exceed	25 mrem to whole body 75 mrem to thyroid 25 mrem to other critical organ
40 CFR 268.1	Applicable exceptions for which otherwise prohibited wastes may be disposed of in a landfill	

Table B-1. Tank Waste Remediation System Externally Imposed Requirements.

External Code or Regulation	Description	Pertinent Numeric Values
40 CFR 268.37	Land Disposal Restrictions - Certain wastes prohibited from land disposal	"waste specified ... as D001 and ... D002 ... are prohibited from land disposal"
40 CFR 268.40	Land Disposal Restrictions - Applicability of Treatment Standards	Table CCWE lists maximum concentration of hazardous constituent that is restricted from land disposal
	DOE Orders	
DOE 5480.4	Specifies requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards applicable to all DOE and DOE contractor operations; to provide a listing of reference ES&H standards; and to identify the sources of the mandatory and reference ES&H standards	
DOE 5480.11 Superseded by the Hanford Site Radiological Control Manual	Exposure of occupational worker to radiation resulting from routine DOE activities	Stochastic Effects annual effective dose equivalent to external and internal sources of occupational worker 5 rem Non-Stochastic Effects annual dose equivalent for individual organs and tissues Lens of eye 15 rem Any other organ 50 rem Unborn Child 0.5 rem Public member onsite per year Internal and External 0.1 rem Dose equivalent to tissue 5 rem External radiation exposure limits in controlled workspace areas ALARA or 0.5 mrem/hr on average
DOE 5820.2A	Mixed TRU waste meeting the WIPP shall be set to the WIPP Concentration limit for TRU radionuclides for LLW	 LLW. TRU radionuclide concentrations than 100 nCi/g
DOE 5820.2A III, 2.c	DOE LLW shall be disposed of on the site at which it is generated	
DOE 5820.2A III, 3	General LLW management and disposal requirements regarding: performance objectives, performance assessment, waste generation, waste characterization, waste acceptance criteria, waste treatment, shipment, long-term storage, disposal, and records and reports	See 10 CFR 61 series for pertinent values

Table B-1. Tank Waste Remediation System Externally Imposed Requirements.

External Code or Regulation	Description	Pertinent Numeric Values
Washington Administrative Code		
WAC 173-303-630	Regulations applicable to tank systems that store dangerous wastes	Requires weekly check of containers for leaks and deterioration; must have containment system capable of holding leaks; ignitable and/or reactive waste must be stored at distances according to "American Table of Distances for Storage or Explosives"; at closure, all dangerous waste and waste residues must be removed from the containment system
WAC 173-303-640	Regulations applicable to tank systems that treat or store dangerous wastes	Requires assessment of integrity of existing tanks; provides design and construction requirements for new tanks; details secondary containment requirements for existing tanks; gives general operating requirements and closure and post-closure requirements including "... remove or decontaminate all waste residues ..."
WAC 173-400	Nonradioactive Air Emissions, New Source Review/NOC; Source Registration	See Regulation
WAC 173-460	Nonradioactive Air Emissions, TAPs	See Regulation
WAC 173-480-40	Ambient air quality standards and emission limits for radionuclides	Limits (annual dose) • Whole body 25 mrem/y • Critical organ 75 mrem/y
WAC 246-247	Ambient Air Quality Standards and Emission Standards shall be those promulgated by Ecology in Chapter 173-480 WAC	Consistent with WAC 173-480-40
SEN-35-91	Establishes the basic nuclear safety policy for DOE facilities	Restricts prompt fatality risk to 0.1% of prompt fatalities from all other accidents--distance assumed to be 1 mile Restricts cancer fatality risk to 0.1% of sum of all cancer fatality risks--distance assumed to be 10 miles

Table B-1. Tank Waste Remediation System Externally Imposed Requirements.

External Code or Regulation	Description	Pertinent Numeric Values
Resource Conservation and Recovery Act		
RCRA, Para. 6924	Standards for hazardous TSD facilities	Lists concentrations of hazardous chemical wastes prohibited from land disposal and indefinite storage including: • Cadmium 100 mg/l • Chromium 500 mg/l • Lead 500 mg/l • Nickel 134 mg/l • Halogenated organic compounds 1,000 mg/kg
Hanford Controlled Manuals		
Hanford Site Radiological Control Manual, Sections 111, 112	Summary of all health and safety regulations	

POTENTIAL TWRS REQUIREMENTS SOURCE DOCUMENTS

Table B-2. Source Documents for Functions and Requirements.

Source	Description
10 CFR 20	Standards for Protection Against Radiation
10 CFR 61	Licensing Requirements for Land Disposal of Radioactive Waste
10 CFR 71	Packaging and Transportation of Radioactive Material
10 CFR 436	Federal Energy Management and Planning Programs; Life-Cycle Cost Methodology and Procedures
10 CFR 835	Occupational Radiation Protection
29 CFR 1910	Occupational Safety and Health Standards
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)
40 CFR 125	Criteria and Standards for the NPDES (National Pollutant Discharge Elimination System)
40 CFR 191	Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes
40 CFR 240	Guidelines for the Thermal Processing of Solid Wastes
40 CFR 241	Guidelines for the Land Disposal of Solid Wastes
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions (LDR)
40 CFR 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
Bernero 1993	Bernero 1993, NRC letter dated March 2, 1993
DOE/EIS-0113	Final EIS-Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes
DOE Order 1300.2A	Department of Energy Technical Standards Program
DOE Order 1540.3A	Base Technology for Radioactive Material Transportation and Packaging Systems
DOE Order 4700.1	Project Management System
DOE Order 5400.1	General Environmental Protection Program
DOE Order 5400.2A	Environmental Compliance Issue Coordination
DOE Order 5400.5	Radiation Protection of the Public and the Environment
DOE Order 5480.3	Nuclear Safety Analysis Reports
DOE Order 5480.4	Environmental Protection, Safety and Health Protection Standards
DOE Order 5480.7	Fire Protection

Table B-2. Source Documents for Functions and Requirements.

Source	Description
DOE Order 5480.11	Radiation Protection for Occupational Workers
DOE Order 5480.23	Safety Requirements for the Packaging and Transportation of Hazardous Substances and Hazardous Wastes
DOE Order 5480.28	Natural Phenomena Hazards Mitigation
DOE Order 5481.1B	Safety Analysis and Review System
DOE Order 5482.1B	Environment, Safety and Health Appraisal Program
DOE Order 5483.1A	Occupational Safety and Health Administration (OSHA) Program at Government-Owned Contractor Operated Facilities
DOE Order 5700.6C	Quality Assurance
DOE Order 5820.2A	Radioactive Waste Management
DOE Order 58XX.XX	Transition of Facilities to the Office of Environmental Restoration and Waste Management, Draft, August 27, 1992
DOE Order 6430.1A	General Design Criteria
DOE RL Order 90-43, Rev. 0, 1 Part B	Liquid Effluent Retention Facility Dangerous Waste Permit Application
DOE RL Order 93-08	Hanford Mission Plan, Volume 1, Site Guidance
DOE RL Order 94-001	DNFSB Recommendation 93-5, Implementation Plan, January 1994
DOE/RL Order 95-07	Hanford Site Air Operating Permit Application
DOE/RW-0351P	Waste Acceptance System Requirements Document, Rev. 0
DOE Secretary Direction of September 13, 1993	Secretary's Safety Initiatives
DOE/WIPP-069	Waste Acceptance Criteria for the Waste Isolation Pilot Plant
EM-WAPS Rev. 0, February 1993	Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms
External Letter, 9360588	DOE Planning Basis for TWRS, December 10, 1993
Federal Register, Vol. 55	No. 238, Tuesday, December 11, 1990 Notices, Enclosure 1
OSD-T-151-00007	Operating Specification for the 241-AN, AP, AW, AY, AZ, and SY Tank Farms
SEN-35-91	Nuclear Safety Policy
TPA (Tri-Party Agreement)	Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)
TWRS Leadership Council Meeting dated January 7 to 9, 1993.	Meeting Minutes
WAC 173-200	Water Quality Standards for Groundwaters of the State of Washington
WAC 173-303	Dangerous Waste Regulations
WAC 173-400	Nonradioactive Air Emissions, New Source Review/NOC; Source Registration
WAC 173-460	Nonradioactive Air Emissions, TAPs
WAC 173-480	Ambient Air Quality Standards and Emission Limits for Radionuclides
WAC 246-247	Radiation Protection - Air Emissions

Table B-2. Source Documents for Functions and Requirements.

Source	Description
WHC-CM-5-6	B Plant Administration
WHC-CM-7-5	Environmental Compliance
WHC-EP-0182	Tank Farm Surveillance and Waste Status Summary Report
WHC-EP-0549	Hanford Strategic Analysis Study, Vol. 1 through 5
WHC-EP-0560 WHC-SD-DD-TI-057	Miscellaneous Underground Radioactive Waste Tanks/Summary of Radioactive Underground Tanks Managed by Hanford Restoration Operations
WHC-SD-HWV-DP-001, Rev. 5	Hanford Waste Vitrification Plant Technical Data Package
WHC-SD-WM-ER-029	Waste Volume Projection Tank Space Management Board Waste Volume Reduction, Double-shell Tank, Grout, Evaporator, LERF
WHC-SD-WM-OCD-015	Tank Farm Waste Compatibility Program
WHC-SD-WM-SAR-023	242-A Evaporator/Crystallizer Safety Analysis Report
WHC-SD-WM-TI-543, Rev. 1	Radionuclide and Chemical Inventories for the Double Shell Tanks

Table B-3. Source Documents for the Technical Requirements Specification.

Source	Description
10 CFR 20	Nuclear Regulatory Commission Standards for Protection Against Radiation
10 CFR 835	Occupational Radiation Protection
15 USC 2601, et seq.	Toxic Substances Control Act
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 148	Hazardous Waste Injection Restrictions
40 CFR 241	Guidelines for the Land Disposal of Solid Waste
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
42 USC 300, et seq.	Safe Drinking Water Act
42 USC 2011, et seq.	Atomic Energy Act of 1954
42 USC 7401, et seq.	Clean Air Act
42 USC 10101	Nuclear Waste Policy Act
49 CFR 100 to 179	DOT Hazardous Materials Regulations
52 FR 2822	Radiation Protection Guidance to the Federal Agencies for Occupational Exposure
55 FR 37174	DOE Compliance with the National Environmental Policy Act (NEPA), Amendments to the DOE NEPA Guidelines, September 8, 1990
DOE Order 5480.3	Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes
DOE Order 5480.4	Environmental Protection, Safety, and Health Protection Standards
DOE Order 5480.5	Safety of Nuclear Facilities
DOE Order 5480.7	Fire Protection
DOE Order 5483.1A	Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities
DOE/RW-0187	Interim storage shall be provided onsite for (TBD) canisters
GR 80-7	General Regulation of the Benton-Franklin-Walla Walla Counties Air Pollution Control Authority
RCW 70.94	Washington Clean Air Act
RCW 70.95	Solid Waste Management - Recovery and Recycling
RCW 70.107	Washington Noise Control Act
RCW 90.48	Water Pollution Control
RCW 90.76	Underground Storage Tanks
RL Order 4320.2C	Site Selection
RL Order 5480.4B	Environmental Protection, Safety, and Health Protection Standards for RL
WAC 173-340	Model Toxics Control Act Cleanup

Table B-3. Source Documents for the Technical Requirements Specification.

Source	Description
WHC-CM-4-29	Nuclear Criticality Safety Manual
WHC-CM-2-14	Hazardous Material Packaging and Shipping
WHC-CM-6-1	Standard Engineering Practices

Table B-4. Source Documents for Design Requirements Document.

Source	Description
DOE Order 5480.19	Conduct of Operations Requirements for DOE Facilities
DOE Order 6430.1A	General Design Criteria
DOE RL Order 5483.1B	Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor Operated (GOCO) Facilities
DOE RL Order 6430.1C	Hanford Plant Standards (HPS) Program
WAC 173-160	Minimum Standards for Construction and Maintenance of Wells
WAC 173-460	Controls for New Sources of Toxic Air Pollutants
WAC 173-490	Emission Standards Controls for Sources Emitting Volatile Organic Compounds (VOC)
WHC-CM-6-4	Hanford Hoisting and Rigging Manual

Table B-5. Source Documents for Programmatic Requirements.

Source	Description
10 CFR 60	Disposal of High-Level Radioactive Wastes in Geologic Repositories
10 CFR 1021	Compliance with the National Environmental Policy Act
10 CFR 1022	Floodplain Management and Protection of Wetlands
29 CFR 1910	Occupational Health and Safety Standards
40 CFR 51	Requirements for Preparation, Adoption, and Submittal of Implementation Plans
40 CFR 52	Approval and Promulgation of Implementation Plans
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 70	Operating Permit Program (Proposed)
40 CFR 141	National Primary Drinking Water Regulations
40 CFR 143	National Secondary Drinking Water Regulations
40 CFR 144	Underground Injection Control Program
40 CFR 145	State UIC Program Requirements
40 CFR 146	Underground Injection Control Program: Criteria and Standards
40 CFR 260	Hazardous Waste Management System - General
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment etc.
40 CFR 268	Land Disposal Restrictions (LDR)
40 CFR 355	Emergency Planning and Notification
40 CFR 370	Hazardous Chemical Reporting: Community Right-to-Know
40 CFR 372	Toxic Chemical Release Reporting: Community Right-to-Know
40 CFR 763	Asbestos
40 CFR 1500 to 1517	Council on Environmental Quality
42 USC 4321, et seq.	National Environmental Policy Act of 1969
42 USC 6901, et seq.	Resource Conservation and Recovery Act of 1976 (RCRA) and Hazardous and Solid Waste Amendments of 1984 (HSWA)
42 USC 11001, et seq.	Emergency Planning and Community Right-to-Know Act of 1986
49 USC 1801, et seq.	Hazardous Materials Transportation Act
52 FR 47662	DOE Compliance with the National Environmental Policy Act (NEPA), Amendments to the DOE NEPA Guidelines, December 15, 1987
91NM-177	Ecology Consent Order
Article 10	Removal and Encapsulation of Asbestos Material (Benton-Franklin-Walla Walla Counties Air Pollution Control Authority
DE 86-133	Ecology Consent Agreement and Compliance Order

Table B-5. Source Documents for Programmatic Requirements.

Source	Description
DOE Order 231.1	Occurrence Reporting
DOE Order 1324.2A	Records Disposition
DOE Order 1324.5A	Records Management Program
DOE Order 1330.1D	Computer Software Management
DOE Order 1370.2A	Computer-Aided Design, Engineering, and Manufacturing Resources
DOE Order 1540.1	Materials Transportation and Traffic Management
DOE Order 1540.2	Hazardous Material Packaging for Transport - Administrative Procedures
DOE Order 2250.1D	Cost and Schedule Control Systems Criteria
DOE Order 2320.1C	Cooperation with the Office of the Inspector General
DOE Order 4010.1A	Value Engineering
DOE Order 4330.2D	In-House Energy Management
DOE Order 4330.4A	Maintenance Management Program
DOE Order 4700.1	Project Management System
DOE Order 5000.3A	Occurrence Reporting and Processing of Operations Information
DOE Order 5300.1B	Telecommunications
DOE Order 5400.1	General Environmental Protection Program
DOE Order 5400.2A	Environmental Compliance Issue Coordination
DOE Order 5400.3	Hazardous and Radioactive Mixed Waste Program
DOE Order 5480.9	Construction Safety and Health Program
DOE Order 5480.10	Contractor Industrial Hygiene Program
DOE Order 5480.19	Conduct of Operations Requirements for DOE Facilities
DOE Order 5480.20	Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities
DOE Order 5480.21	Unreviewed Safety Questions
DOE Order 5480.22	Technical Safety Requirements
DOE Order 5480.23	Nuclear Safety Analysis Reports
DOE Order 5480.24	Nuclear Criticality Safety
DOE Order 5480.31	Startup and Restart of Nuclear Facilities
DOE Order 5481.1B	Safety Analysis and Review System
DOE Order 5482.1B	Environment, Safety, and Health Appraisal Program
DOE Order 5484.1	Environmental Protection, Safety, and Health Protection Information Reporting Requirements
DOE Order 5500.3A	Planning and Preparedness for Operational Emergencies
DOE Order 5630.11	Safeguards and Security Program
DOE Order 5630.12	Safeguards and Security Inspection and Evaluation Program
DOE Order 5700.6C	Quality Assurance

Table B-5. Source Documents for Programmatic Requirements.

Source	Description
DOE RL Order 1324.1A	Records Disposition
DOE RL Order 4330.1	Maintenance or Property
DOE RL Order 4330.2	Water Treatment Plants and Distribution Systems
DOE RL Order 5440.1A	Implementation of the National Environmental Policy Act at the Richland Operations Office
DOE RL Order 5480.5	Safety of Nuclear Facilities
DOE RL Order 5481.1	Safety Analysis and Review System
DOE RL Order 5483.1B	Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor Operated (GOCO) Facilities
DOE RL Order 5484.1	Environmental Protection, Safety, and Health Protection Information Reporting
Exec Order 11988, 11990	Floodplain Management and Protection of Wetlands
Exec Order 12088	Federal Compliance with Pollution Control Standards
Exec Order 12780	Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy
PL 101-510 Sec 3137	Wyden Amendment
RCW 43.21C	State Environmental Policy Act (SEPA)
RCW 70.98	Nuclear Energy and Radiation
RCW 70.105	Washington Hazardous Waste Management Act
RCW 70.105D	Model Toxics Control Act
SEN 15-90	National Environmental Policy Act
WAC 173-162	Regulation and Licensing of Well Contractors and Operators
WAC 173-216/ST 4500 Permit	State Waste Discharge Permit Program/Permit #4500
WAC 173-218	Underground Injection Control Program
WAC 173-240	Submission of Plans and Reports for Construction of Wastewater Facilities
WAC 173-304	Minimum Functional Standards for Solid Waste Handling
WAC 173-360	Underground Storage Tank Regulations
WAC 173-400	General Regulations for Air Pollution Sources
WAC 173-460	Toxic Air Pollutants
WAC 173-480	Ambient Air Quality Standards and Emission Limits for Radionuclides
WAC 173-490	Emission Standards and Controls for Sources Emitting Volatile Organic Compounds (VOCs)
WAC 173-802	SEPA Procedures
WAC 197-11	SEPA Documentation
WAC 246-247	Radiation Protection Air Emissions
WAC 246-272	On-site Sewage System
WAC 246-290	Public Water Supplies
WAC 402-80	Monitoring and Enforcement of Air Quality and Emission Standards for Radionuclides

Table B-5. Source Documents for Programmatic Requirements.

Source	Description
WHC-CM-1	Management Policies
WHC-CM-1-3 MRP 5.12 EH 89-1	Management Requirements and Procedures
WHC-CM-1-5	Standard Operating Practices
WHC-CM-2-1	Procurement Manual and Procedures
WHC-CM-2-2	Materials Management Manual
WHC-CM-2-3	Property Management Manual
WHC-CM-2-5	Management Control System
WHC-CM-2-15	Training Administration Manual
WHC-CM-3-4	Information Release Administration
WHC-CM-3-5	Document Control and Records Management Manual
WHC-CM-3-6	Uniform Publications System
WHC-CM-4-33	Security Manual
WHC-CM-4-40	Industrial Hygiene Manual
WHC-CM-4-41	Fire Protection Program Manual
WHC-CM-4-46	Nonreactor Facility Safety Analysis Manual
WHC-CM-6-2	Project Management
WHC-CM-8-7	Operations Support Services

Table C-1. Initial Unacceptable State. (4 sheets)

Topic Number	Topic Description	Include or Exclude	Initial Conditions
1.1	Waste materials		The waste materials, lines, tanks, equipment, and facilities to be included in the TWRS are identified in this table: the initial characteristics of these items are not yet determined
1.1.1	Tank waste (radioactive and hazardous waste contained in or that will be received into TWRS tanks, lines, equipment, or facilities)		Contained in DSTs, SSTs, and miscellaneous underground storage tanks
1.1.1.1	DST waste	Include	• Open safety issues • Not fully characterized • Liquid, and sludge • Highly radioactive • Mixed waste • High sodium content • Contained in 28 DSTs
1.1.1.2	SST waste	Include per Secretary Decision Letter (Anttonen 1991) and TWRS EIS notice of intent (assumed)	• Open safety issues • Not fully characterized • Mostly sludge and salt cake with some liquid • Highly radioactive • Mixed waste • High sodium content • Partially stabilized • Contained in 149 SSTs
1.1.1.3	Inactive miscellaneous underground storage tank waste under TWRS ownership	Include per MOA (Rasmussen 1995) (see Issue 10) Powers 1995	• Not characterized • Highly radioactive • Mixed waste • Liquid, Sludge • Solids
1.1.2	Line waste	Include	• Solidified in plugged transfer lines • Highly radioactive • Not characterized
1.1.3	Capsules	Storage is excluded	Onsite capsules are currently stored in the Waste Encapsulation and Storage Facility
1.1.3.1	Strontium (606 onsite and 4 offsite capsules)	Include disposal	• SrF • 8.5 E+17 Bq (23.0 MCi) onsite (7/1/95) • 1.1 E+16 Bq (0.3 MCi) offsite (7/1/95)

Table C-1. Initial Unacceptable State. (4 sheets)

Topic Number	Topic Description	Include or Exclude	Initial Conditions
1.1.3.2	Cesium (1,270 onsite and 58 offsite capsules)	Include disposal	• CsCl • 1.9 E+18 Bq (50.3 MCi) onsite (7/1/95) • 8.6 E+16 Bq (2.3 MCi) offsite (7/1/95) • 1 leaking capsule offsite (has been shipped back to site) • 14 capsules are suspect
1.1.4	New liquid tank waste	Consider as interface with other missions not as initial condition.	• Ongoing additions to tank system • Not acceptable for discharge as a liquid effluent
1.1.4.1	Liquid tank waste generated by interfacing Hanford Site mission areas, e.g., • ER from cleanup of - Contaminated soils - Contaminated groundwater - Solid waste contained in past-practice units • Solid Waste from cleanup of - Solid materials stored in facilities or burial trenches • Liquid Waste from cleanup of - Waste materials resulting from not discharging liquid effluents to the soil • Nuclear Facilities waste from ongoing processing, operations, laboratory analyses, and cleanup	Consider as interface with other missions not as initial conditions	• Ongoing additions to tank system • Not acceptable for discharge as a liquid effluent
1.1.4.2	TWRS generated waste • Line flushes • Volume makeups	Consider as part of program internals not as initial conditions or interfaces with other missions	• Ongoing additions to tank system • Not acceptable for discharge as a liquid effluent
1.1.5	Production reactor fuel assemblies	Exclude	
1.1.6	Radioactive waste materials remaining at nuclear facilities	Exclude	
1.1.7	TWRS liquid effluents	• Exclude final discharge • Include treatment to acceptable limits	• Phase I effluents contained in Liquid Effluent Retention Facility • Phase II effluents discharged to B Pond LERF
1.1.8	Contaminated soils	Exclude	
1.1.8.1	Tank leaks	Include per MOAs (Wagner 1994, Rasmussen 1995) (see Issues 8, 9, and 10)	Soils contaminated by tank leaks are considered part of the system.
1.1.9	Buried waste	Exclude	

Table C-1. Initial Unacceptable State. (4 sheets)

Topic Number	Topic Description	Include or Exclude	Initial Conditions
1.1.10	Special project materials	Exclude	
1.2	TWRS equipment	Exclude disposal	
1.2.1	Underground storage tanks	Include (see Issues 8, 9, and 10)	
1.2.1.1	DSTs	Include (see Issue 8)	Some tanks are approaching end of design life, most are not
1.2.1.2	SSTs	Include per MOA (Rasmussen 1995) (see Issue 10)	• Beyond design life • Some tanks leak • Continue to deteriorate
1.2.1.3	Miscellaneous tanks (60)	Include per MOA	Contain radioactive inventories
1.2.2	Process equipment, e.g., • Process vessels - Tanks - Ion exchange columns - Melter - Associated equipment • Pumps, jets, etc. • Process piping - Valves - Pipes - Jumpers • Low-level radioactive waste - Tools - Clothing	Exclude disposal	To be determined
1.2.3	Transfer lines • Within tank farms • Between facilities and tank farms • Cross-site	Exclude disposal	To be determined
1.3	TWRS facilities	Exclude disposal	
1.3.1	Existing facilities, e.g., • 242-A* • 242-T • 242-S • 244-AR	Exclude disposal	• Poorly maintained • Aging, some beyond initial design life *242-A has been recently upgraded, renovated, and successfully operated.

Table C-1. Initial Unacceptable State. (4 sheets)

Topic Number	Topic Description	Include or Exclude	Initial Conditions
1.3.2	New facilities	Exclude disposal	
1.3.3	Cribs, ponds, ditches	Exclude	Contaminated with radioactive and hazardous waste
1.4	Current waste tank operations	Include for ongoing operations	
1.4.1	Tank systems and instrumentation		• Functional, but modernization needed • Additional monitoring capability probably needed.
1.4.3	Conduct of operations • Training • Procedures • Timeliness and adequacy of maintenance • Performance measurement	Include for ongoing operations	• Compliant with existing regulations • Resolution of unresolved safety questions in progress

APPENDIX D
DEFINITIONS AND STANDARD TERMINOLOGY

Alternative (used as adjective only). Offering or expressing a choice between two or more things.

Boundary. The border that establishes the interface for inputs and outputs of the system.

Closure. Process by which a hazardous waste treatment, storage, or disposal facility, which has discontinued operation, is dispositioned in accordance with a Washington State-approved closure plan.

Constraints. Restrictions or limitations that must be met. Constraints are used to screen alternative strategies and are always nontradable by the designer (as opposed to requirements which are tradable).

Decision Measures. A set of quantifiable metrics used in making decisions for the selector of alternatives.

Disposal. Placement of waste in a manner that ensures isolation from the biosphere for the foreseeable future with no intent of retrieval and requires deliberate action to regain access to the waste.

Dispose. To place waste in a manner that ensures isolation from the biosphere for the foreseeable future with no intent of retrieval and requires deliberate action to regain access to the waste.

Enable Assumption. These assumptions will be carried into the functional analysis and identified and tracked from identification through resolution or validation of the assumption.

Environment. (1) The land, water, and atmosphere of a specific area; (2) the circumstances or conditions in which a system exists. External environments are unaffected by the system; internal environments are created by the system and may be affected by it.

Function. A specific action, activity, or process that achieves or supports the achievement of an objective (e.g., an operation that a system must perform to accomplish its mission).

Goals. Statements describing the desired end points.

High-level radioactive waste (see DOE Order 5820.2A). "The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation."

Immobilization. A process that prepares waste for disposal.

Interface. System boundary across which material, data, or energy passes.

Low-level radioactive waste (see DOE Order 5820.2A). "Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material as defined by 5820.2a. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 100 nCi/g."

Measure of success. A set of attributes that, when compared to actual results, show how well the mission was accomplished.

Objectives. Discrete, measurable events that, if accomplished, will contribute to achieving a goal.

Pretreatment. Chemical treatment process or a series of processes used to prepare waste for immobilization.

Problem statement. A declaration of what is wrong and needs to be corrected to improve a situation.

Program. An organized set of activities directed toward a common purpose. Programs are typically made up of technology base activities, projects, and supporting operations.

Project. A unique major effort within a program that has a firmly scheduled beginning, intermediate, and ending date milestones.

Public involvement. A process by which the stakeholders' views are integrated into the U.S. Department of Energy's (DOE) decision-making process. The stakeholders' issues, concerns, and values will be understood and considered when making decisions. Public involvement is a dialogue between DOE and the stakeholders. This interaction goes beyond the public receiving information and providing comments after the decision is made.

Remediation. Action taken to safely store, maintain, treat, and dispose of tank waste. NOTE: Waste is remediated, not safety issues; however, waste remediation may resolve a safety issue.

Requirement. How well the system needs to perform a function. Requirements are always tradable by the system designer (as opposed to constraints which are not tradable).

Resolution. Elimination of a tank safety issue by physical, chemical, analytical, and/or administrative methods.

Restoration. Return to the operating condition for which something was originally designed.

Restricted use. Limits are placed on the use of the land area (surface, subsurface, and groundwater), in terms of the hours of occupancy and/or the activities allowed. Institutional controls are required to define and enforce the limits.

Risk. Health and safety or environmental issues that may adversely impact the program's ability to meet regulatory requirements.

Salt cake. Various salts formed from the evaporation of alkaline wastes.

Secondary waste. The waste generated as a result of contact with high- level and low-level radioactive waste (e.g., liquid effluents, failed equipment, clothing, tools, facilities, tanks).

Sludge. Solids left in single shell tanks after pumpable liquids have been removed; and solids that precipitated from chemical processes in double shell tanks.

Stakeholder. Any person or group that is potentially affected by actions at the Hanford Site.

Store (Storage). The activity necessary for the safe holding of tank waste, capsules, and any other radioactive or hazardous materials.

Strategy. A plan or approach to accomplish the mission.

System. A combination of related functions or equipment integrated into a single activity.

Tank safety issue. A potentially unsafe condition associated with high- level radioactive tank waste and/or operating tank farm facilities. Tank waste safety issues are a subset of tank safety issues.

Tank waste. Waste currently contained in single-shell tanks (SST), double-shell tanks (DST), all new waste added to DSTs, and cesium and strontium stored in capsules.

Tank Waste Remediation System. An integrated solution for carrying out the specific functions associated with remediating tank waste.

Tank Waste Remediation System Program. An integrated program for carrying out the specific functions associated with remediating tank waste.

Tank Waste Remediation System Program Leadership Council. A group consisting of a single, senior manager from the U.S. Department of Energy-Headquarters; U.S. Department of Energy, Richland Field Office; Westinghouse Hanford Company; and Pacific Northwest Laboratory with the authority to make decisions and provide direction to the Tank Waste Remediation System Program. The leadership council was chartered by the Assistant Secretary for Environmental Restoration and Waste Management.

Tank Waste Remediation System Program mission statement. To store, treat, and immobilize highly radioactive Hanford waste (current and future tank waste and the Sr/Cs capsules) in an environmentally sound, safe, and cost effective manner.

Tank waste safety issue. A potentially unsafe condition associated directly with the high-level radioactive waste within a waste storage tank. Tank waste safety issues are a subset of tank safety issues.

Tradable. A function, requirement, or design solution that may be changed, typically within the context of a trade study. Those that are not tradable are referred to as 'nontradable.'

Trade study. (1) The process of comparing or trading the strengths and weaknesses of alternative approaches or attributes; (2) a feedback process for resolving inconsistencies between steps or levels; (3) the analysis of the ability of a design solution to meet its stated objectives as inputs are varied.

Transuranic waste (see DOE Order 5820.2A). "Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lifes greater that 20 years and concentrations greater than 100 nCi/g at the time of assay."

Treatment. Process or processes that change waste in preparation for disposal.

Unrestricted use. No limits are placed on the use of the land area (surface, subsurface, and groundwater) because of residual materials after cleanup. Past uses, related to the defense mission at the Hanford Site, of the area no longer impact land-use planning. Unrestricted public access or

ownership could occur. However, they may be other reasons to limit access, such as cultural features or wildlife habitat.

Upgrade. Place in an operating condition that is superior to the condition for which it was originally designed.

Watch list tank. An underground storage tank containing waste that requires special safety precautions because it may have a serious potential for release of high-level radioactive waste because of uncontrolled increases in temperature or pressure. Special restrictions have been placed on these tanks by Public Law 101-510, Section 3137, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation" (also known as the Wyden Amendment).

APPENDIX E
PRIMS

Appendix E will be inserted by ECN when available.

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G. Singh	H6-11	X			
W. A. Skelly	H5-61	X			
J. P. Sloughter	R2-54	X			
P. L. Smith	R3-08	X			
C. L. Sohn	S7-51	X			
R. R. Stickney	H6-35	X			
J. Teal	H6-33	X			
A. M. Umek	S7-81	X			
R. W. Unger	S7-53	X			
J. H. Wicks	R2-50	X			
R. S. Wittman	H6-35	X			
D. D. Wodrich	S7-50	X			
R. D. Wojtasek	S7-84	X			
B. D. Zimmerman	H6-35	X			
Central Files	A3-88	X			